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A JOURNAL DEVOTED TO THE INTERESTS, PRACTICE, AND PROGRESS OF AERIAL LOCOMOTION AND TRANSPORT.

OFFICIAL ORGAN OF THE ROYAL AERO CLUB OF THE UNITED KINGDOM.

No. 416. (No. 50, Vol. VIII.) Registered at the General Post Office as a Newspaper. DECEMBER 14, 1916. One Penny Weekly.

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OFFICIAL ORGAN OF THE ROYAL AERO CLUB OF THE UNITED KINGDOM.

No. 416. (No. 50, Vol. VIII.)] DECEMBER 14, 1916. [Weekly, Price 1d. Post Free, 1½d.

Flight.

Editorial Office: 44, ST. MARTIN'S LANE, LONDON, W.C.
Telegrams: Truditur, Westrand, London. Telephone: Gerrard 1828.
Annual Subscription Rates, Post Free.
United Kingdom .. 6s. 6d. Abroad .. .. .. 11s. 0d.

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NOTICE.—Owing to Christmas Day and Boxing Day falling on Monday and Tuesday in Christmas week, it is necessary that all copy, Editorial and Advertisement, for the issue of December 28th, should reach "FLIGHT" Office not later than the morning of December 20th.

EDITORIAL COMMENT.

The Road to Victory.

WHAT a dramatic change has taken place in the aspect of things political since the beginning of the latest Cabinet crises! A fortnight ago there seemed to be no hope but that the conduct of the war would remain in the hands of the lawyer-politician combine who have stood for two long years athwart the road to victory. There seemed to be no hope of progress, no hope that the policy of "wait and see" would be departed from until, too late, the people themselves realised that everything had been given away by the leaders who did not lead and who put the sweets of office before the necessities of the Empire. To-day we have a "Business Government" in which the lawyer element, save in the case of the legal offices, is mainly conspicuous by its absence. Instead, we have Ministers selected for their posts because of the special qualifications they possess for those posts. We have a War Council of five Ministers who are to be responsible for the whole conduct of the war, while the rest of the departmental heads are left free to conduct the business of their departments and to carry out the instructions of the War Council in so far as they relate to the various departments of State. On paper at least the new constitution of the Government approaches as nearly to the ideal as may be imagined. In practice, it is so radical a departure from all accepted traditions that it really constitutes the greatest governmental experiment in all our constitutional history. While we call it an experiment—and quite rightly—we would hasten to add that it is an experiment that has been made not a moment too soon. When we regard the happenings of the past twenty-eight months, we marvel that it has been so late in the day that THE MAN has arisen to give us the new in place of the old. Blundering diplomacy and hesitating strategy, the perpetuation of inter-departmental jealousies, the farcical domestic regulations under that farcical piece of legislation the Defence of the Realm Act, the piffling attempts to deal with the food problem—all have combined to lead the thinking citizen to despair. We have had supposedly responsible Ministers of the Crown laying down in sonorous periods that this war is "a fight to a finish" and that "Britain would never sheathe the sword until Prussian militarism was destroyed"—and then going home to sleep! We have been told that the nation would be asked to make great sacrifices, and

that we should have to deny ourselves many things to achieve success—while Ministers and Members of Parliament have comfortably and quietly drawn their salaries and denied themselves nothing. What wonder that the nation had become sick and tired of the whole crowd? There is no doubt that a grave volume of intense dissatisfaction had grown up as a consequence of the policy of *laissez faire* which was the principal characteristic of the late Government's conduct of affairs. Unquestionably this feeling of profound dissatisfaction was approaching a head, and we are gravely of opinion that if Mr. Lloyd George had not acted as he has there was serious danger of a sinister page of our history having to be written.

He has acted—fortunately in time. It will be by the future that he will be judged. The nation has the profoundest faith in him and is prepared to trust him to the uttermost. In return the nation will require at his hands deeds, and not the empty words of the old political clique. It is a heavy responsibility he has assumed, and it will be a heavy reckoning that the nation will exact should he fail of his own default. For the very reason that he himself has looked the situation squarely in the face and has accepted all the risks, it is for the nation to give him implicit trust. He will ask of us more and greater sacrifices than we have been called upon for in the past. They will be cheerfully made—because we trust him to lead us along the road to victory.

◆ ◆ ◆

What of the Air?

It is impossible for us who are so closely identified with the future in the air to regard the momentous happenings of the past few days without speculating on their possible influence on our aerial policy. When the late "crisis" came upon us we were looking forward to seeing the house put in order and an end made of the obstructionist tactics which had militated against the work of the Air Board. As we said last week, we deplored the necessity for washing dirty linen in public, though it was better washed publicly than not at all. To expose our weaknesses and show ourselves in the face of the enemy as a house divided against itself was something that on every ground was to be deprecated. But at the time there seemed no other method by which the differences that have militated against the successful expansion of the Air Services could be eliminated. The first essential was to get rid of those differences, and if that could only be accomplished as a result of open debate in Parliament—well, that was a choice of the lesser evil.

We see now in the reconstituted Government a good augury for the future. Lord Curzon, who is—or should we say was?—Chairman of the Air Board, is a member of the new War Council. We know he feels very strongly that supremacy in the air is vital to winning the war, and we may be sure that all his influence will be on the side of setting the house in order. And, as the War Council is to be supreme and the departments of State are to be subordinate to the Council for the purposes of the war, it almost goes without saying that the necessary reforms in administration will be insisted upon. We are by no means addicted to the endorsement of "wait and see," but in this case that seems to be by far the better course. It is not for the Press to indicate to the new administration the way it should go. It is enough for the moment that it has the entire confidence of the country, which believes that Mr. Lloyd George's Government is one of action all along the line. Therefore, we are content in the meantime to "wait and see." We have got in the new War Council, for the war as a whole, what we have in a restricted way advocated in regard to the control of the Air Services for a long time past—a centralisation of control of the war in all its aspects. We now await the results—let us add, with entire confidence.

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State Aid for Research.

We are getting on! Not so very long ago the very idea of State encouragement of industrial research was enough to raise a smile, but now we find it on the eve of becoming an accomplished fact. In reply to a deputation from the Board of Scientific Societies, Lord Crewe said on Friday of last week that the Government had been impressed by the need of coming further to the help of research. Consideration had been given to the question what should be done—to mention a single point—to assist the great staple industries of the country in developing systematic research on a large scale. It was clear that in the case of large and wealthy industries, where either individuals or limited companies might look to profit on a very large scale as the direct result of research, the country would not be likely to be willing to pay the whole amount devoted to research. The Advisory Council had therefore already devoted much time to conversations with leaders of different great industries in the hope of bringing about a scheme of co-operation between those leaders and themselves.

The matter of scientific research applied to industry was, it was considered, one of the cases in which an exception might be made to the usual plan of procedure by annual estimates. When co-operation of the most varied kind and on entirely different scales had to be instituted between a Government Department and a number of different industries, an attempt to estimate the actual amount required for a given year would be hopeless. Therefore the Chancellor of the Exchequer, who took a deep interest in the subject, was prepared to advise the Government to devote a very large sum, generally estimated to meet the needs for this co-operation for the period of the next five years, on a scale which ought to enable them to spend certainly four and possibly five times as much on this object of co-operation between the department and the firms as had been spent for the whole purposes of research by vote hitherto.

The Inland Revenue had told him that the Chancellor of the Exchequer had decided that no objection should be offered by their surveyors of taxes to the allowance as working expenses for income-tax purposes of contributions by traders to industrial associations which might be formed for the sole purpose of scientific research for the benefit of the various trades.

We need hardly say that we welcome so far-reaching a declaration as this, which goes far beyond what the State has ever done for industrial research in the past. In particular, too, we like the departure made in the matter of income and excess profits taxes, which should go very far to induce firms and individuals to prosecute research along the lines intended. It is altogether a notable scheme, and a hopeful one for the future.

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The "Afternoon Tea" Question.

A propos the "afternoon tea" question which was discussed in our columns recently, a valued correspondent sends us a time-table of the alleged hours kept in certain departments of the War Office. This is as follows :—

Assemble for work between 9 and 9.30 a.m.
Tea at 11 a.m.
Lunch at 12.45 p.m.
Return to work at 3 p.m.
Tea at 4 p.m.
Finish work for the day between 6 and 7 p.m.

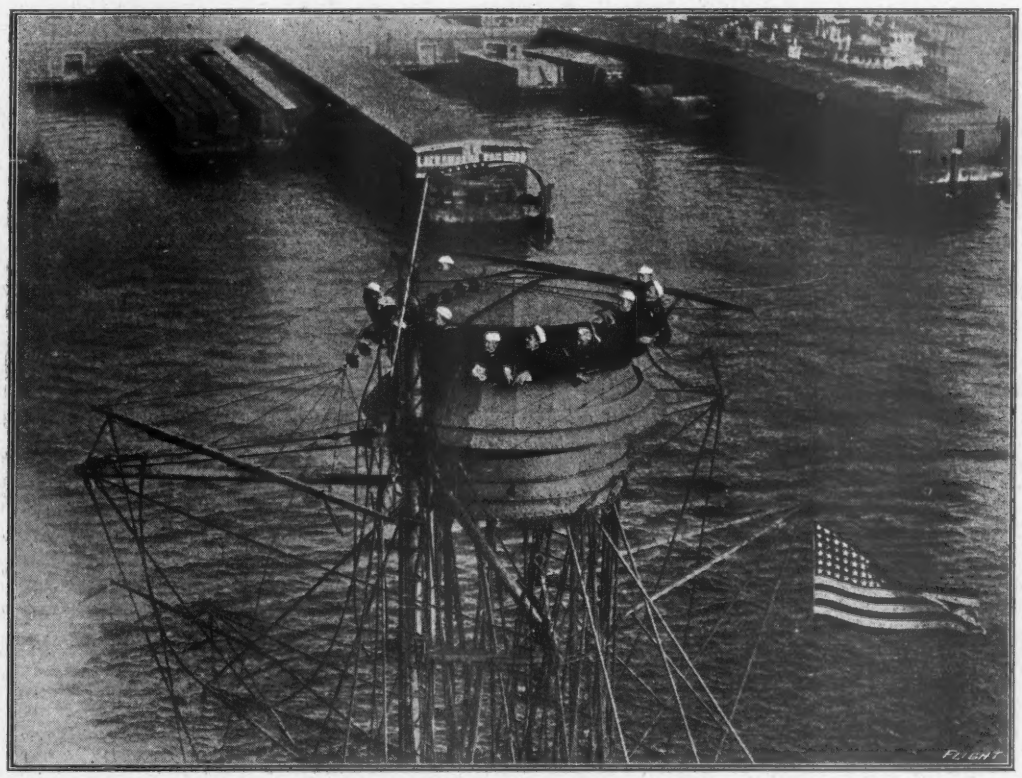
As our correspondent pertinently asks : "What business could stand this sort of thing by the people who are supposed to be managing it ?" Our readers may perhaps think that our correspondent exaggerates, but we have the best reasons for knowing that so far from this being so, the time-table given is not by any means a bad example of the day's work of many officials holding something better than merely subordinate posts. Nor is it peculiar to the War Office. In fact, there are worse offenders in other Government offices than the War Office can produce. Possibly Lord Derby will indulge in a little combing-out of these luxuries of leisure, so that those who are paid to "get on with the war" may have time to do more "getting on." Perhaps, too, the new business heads of some other Government departments may manage to convince their officials that tea and gossip are not the beginning and end of official activity. We are not without hope.

◆ ◆

"X 54" Raid. November 27th-28th.

It was officially announced on December 12th that supplementary reports received from the police with regard to the casualties in the air raid on the night of November 27th-28th show that since November 28th, when the first return of casualties was issued, two of the injured persons have died, there has been a further death from shock, and information has been obtained of a number of cases of slight injury which were treated at home and not reported. The total casualties are as follows :—

	Men.	Women.	Children.	Total.
Killed ..	1	3	—	4
Injured ..	16	14	7	37
Total				41



HOW THE AMERICAN NAVY PROTECTS AGAINST AIRCRAFT ATTACKS FROM ABOVE.—The anti-aircraft fighting-tops of the latest U.S. super-Dreadnought, "Arizona," showing the steel overhead armouring protecting the gun crew from bombs dropped by aircraft.

The British Air Service

"PER ARDUA AD ASTRA"

UNDER this heading are published each week the official announcements of appointments and promotions affecting the Royal Naval Air Service and the Royal Flying Corps (Military Wing) and Central Flying School. These notices are not duplicated. By way of instance, when an appointment to the Royal Naval Air Service is announced by the Admiralty it is published forthwith, but subsequently, when it appears in the LONDON GAZETTE, *it is not repeated in this column.*

Royal Naval Air Service. *Admiralty, December 5th.*

The following Flight-Lieuts. appointed as Acting Flight-Comdrs., all to date Dec. 3rd: E. J. Hodsoll, E. A. de L. de Ville, B. P. H. de Roeper, B. Travers, J. S. Mills, C. D. Morrison, A. R. Cox, R. B. Munday, R. C. Hardstaff, T. F. N. Gerrard and F. H. M. Maynard.

The under-mentioned Flight Sub-Lieuts., appointed as Acting Flight-Lieuts., all to date Dec. 3rd: L. G. Scott, M. J. M. Bryan, P. D. Robertson, G. G. McHardy, A. B. Watkins, D. R. Baylis, H. L. Everitt, D. G. Ronald, A. H. H. Gilligan, C. Murray, K. C. Buss, J. C. Mitchell, E. M. Morgan, B. S. Wemp, L. M. B. Weil, H. L'E. Tyndale-Biscoe, J. K. Waugh, H. Tether and E. L. Pralle.

The following have been entered as Prob. Flight Officers for temp. service, all to date Dec. 10th: W. T. Grieve, R. Halley, L. E. Allen and J. R. Tulley.

B. G. Ludlow granted temp. commission as Sub-Lieut., R.N.V.R., with seniority Dec. 4th.

Admiralty, December 6th.

The following Flight Sub-Lieuts. granted temp. commissions as Sub-Lieut., R.N.V.R., with seniority as mentioned: S. D. Felkin, Dec. 5th; T. H. Harkness and A. E. Mackenzie, Dec. 4th.

Admiralty, December 8th.

A. T. Gray, E. Nichols, H. Constant, R. L. Kent and L. A. Philip entered as Prob. Flight Officers for temp. service, and appointed to "President," additional, for R.N.A.S., all date Dec. 10th.

H. V. Cherry entered as Temp. Warrant Officer, 2nd grade, and appointed to "President," additional, for R.N.A.S., date Dec. 7th.

Admiralty, December 11th.

The following have been entered as Prob. Flight Officers for temp. service and appointed to "President," additional, for duty with R.N.A.S., all date Nov. 17th: W. H. Wilmot, B. B. Ball, W. E. N. Clark, R. E. Horton, C. Chrimes, A. C. Campbell-Orde, G. F. Hyams, G. W. Longley, K. Stuart, H. L. Madge, H. A. Wishaw, M. A. Harker, C. S. Mossop, P. G. Shepherd, J. A. S. Wright, G. D. Hepburn, F. N. Smith and J. M. Mason.

Royal Flying Corps (Military Wing).

London Gazette, December 5th.

Flight-Commanders.—Temp. Lieut. A. M. Thom, M.C., Gen. List, and to be Temp. Capt. whilst so employed; Nov. 1st. (Substituted for the notification in the *Gazette*, of Nov. 27th.) The initials of 2nd Lieut. (Temp. Capt.) H. F. Fisher are as now described, and not as in the *Gazette* of Nov. 25th. The surname of Lieut. (Temp. Capt.) P. A. O. Leask is as now described, and not as in the *Gazette* of Nov. 23rd.

Flying Officer.—Temp. 2nd Lieut. (on prob.) D. H. Robertson, Gen. List; Oct. 22nd. (Substituted for the notification in the *Gazette* of Nov. 8th.)

Equipment Officer, 3rd Class.—2nd Lieut. W. G. Duffield, S.R.; Oct. 28th.

Experimental Officer (graded as an Equipment Officer, 1st Class).—Temp. 2nd Lieut. H. W. Phear, R.A., from a Staff Lieut., to be transfd. to Gen. List, and to be Temp. Capt. whilst so employed; Nov. 15th.

Supplementary to Regular Corps.—2nd Lieut. J. W. G. Mackinlay to be Capt.; Nov. 18th. The under-mentioned 2nd Lieuts. (on prob.) are confirmed in their rank: H. E. Jarman, D. S. Kennedy, G. V. Cottam, R. W. Farquhar. The under-mentioned to be 2nd Lieuts. (on prob.): 2nd Lieut. F. G. Toy, Australian Imperial Force; Oct. 23rd. Lieut. E. D. Perney, Can. Field Art.; Nov. 11th. E. H. Acland; Nov. 14th. Nov. 17th: G. E. Seymour, A. E. McVittie, N. A. Burritt, J. L. Drummond, S. L. Crowther, J. W. Gillespie, L. N. Waddell, F. W. Rook, M. C. Healy, E. N. Hately, G. C. Atkins, H. G. Gonthier, A. L. Fleming, J. A. Raymond, A. McD. McBain, W. H. Falkner, R. W. Makepeace, R. F. Anderson, W. R. A. Campbell.

London Gazette Supplement, December 6th.

Wing Commander.—Capt. (Temp. Lieut.-Col.) G. E. Todd, Welsh R., from a Sqdn. Comdr. and Asst. Comdt., Central Flying School, and to retain his temp. rank whilst so employed; Nov. 23rd.

Flight-Commander.—Capt. C. G. Davidson, S.R., reverts to Flying Officer; Oct. 20th.

Flying Officers.—Nov. 15th: 2nd Lieut. (Temp. Capt.) D. D. Walrond-Skinner, Mon. R. (T.F.); 2nd Lieut. F. H. E. Reeve, Northd. Fus. (T.F.). 2nd Lieut. G. V. Cottam, S.R.; Nov. 16th. Nov. 18th: 2nd Lieut. (Temp. Lieut.) J. A. Williamson, R. E. Kent Yeo. (T.F.), from a Flying Officer (Ob.), with seniority from April 28th. Temp. Lieut. C. G. Gilbert, Dorset R., and to be transfd. to Gen. List; Temp. 2nd Lieut. A. H. Carman, Worc. R., and to be transfd. to Gen. List.

Supplementary to Regular Corps.—G. Barnett to be 2nd Lieut. (on prob.); Sept. 10th.

London Gazette Supplement, December 7th.

The under-mentioned to be Temp. 2nd Lieuts. (on prob.), for duty with R.F.C.:—Nov. 10th: Sergt. E. H. Trump, from R.F.C.; 1st Cl. Air-Mech. S. de Freitas, from R.F.C.; 2nd Cl. Air-Mech. A. G. S. de Ross, from R.F.C.; Pte. L. Y. Cardall, from A.S.C.; Pte. P. Sherman, from Can. A.S.C. Sergt. W. D. Matheson, from R.F.C.; Nov. 12th. Pte. F. B. Palmer, from Can. Corps Cav. Regt.; Nov. 13th.

Equipment Officer, 3rd Class.—2nd Lieut. J. Witt-Mann, S.R.; Nov. 7th.

Supplementary to Regular Corps.

Royal Flying Corps, Military Wing.—The under-mentioned 2nd Lieuts. (on prob.) are confirmed in their rank: A. L. Pattinson, C. A. M. Furlonger. The under-mentioned to be 2nd Lieuts. (on prob.): E. Brown; Sept. 17th. R. S. G. MacLean; Oct. 29th. Nov. 5th: C. W. McKissock, L. H. Meyer, L. M. Hill, E. C. Macdonnell, J. B. Crompton. Nov. 20th: W. H. Bokenham, L. G. Fenner. J. C. Murray; Dec. 4th. The Christian names of 2nd Lieut. (on prob.) Douglas Urchart McGregor are as now described, and not as in the *Gazette* of Oct. 23rd.

London Gazette, December 8th.

Flight-Commanders.—The appointment of Lieut. (Temp. Capt.) E. R. Pretyman, Som. L.I., notified in the *Gazette* of Oct. 11th, is antedated to Sept. 12th. From Flying Officers, and to be Temp. Capts. whilst so employed: 2nd Lieut. J. R. Gould, 2nd Regt., King Edward's Horse, S.R.; Sept. 17th. 2nd Lieut. W. E. Nixon, K.O. Sco. Bord.; Nov. 14th. 2nd Lieut. A. G. Knight, M.C., S.R.; Nov. 16th. From Flying Officers:—Nov. 17th: Temp. Major (Capt., Ind. Army) H. A. Hill, R. Berks. R. (T.F.); Lieut. C. L. Bath, Can. Machine Gun Serv., and to be Temp. Capt. whilst so employed. Nov. 23rd: Lieut. (Temp. Capt.) A. T. Loyd, E. Kent R. (T.F.), and to retain his temp. rank whilst so employed. From Flying Officers and to be Temp. Capts. whilst so employed: 2nd Lieut. C. E. H. C. Macpherson, R. Dub. Fus.; Temp. Lieut. C. W. Hyde, Gen. List; Nov. 25th. Temp. 2nd Lieut. O. V. Thomas, Gen. List; Nov. 27th.

Flying Officers.—Temp. 2nd Lieut. (on prob.) J. R. W. Thompson, Gen. List; Oct. 27th. Nov. 13th: Lieut. (Temp. Capt.) E. E. N. Burney, M.C., R. Berks. R., from a Flying Officer (Ob.), with seniority from June 1st; 2nd Lieut. J. A. Marshall, Hunts. Cyclist Bn. (T.F.). Nov. 14th: 2nd Lieut. (Temp. Lieut.) S. A. Villiers, R.A., from a Flying Officer (Ob.), with seniority from May 31st; 2nd Lieut. A. G. A. Davis, Devon. R., from a Flying Officer (Ob.), with seniority from May 14th. Nov. 15th: Temp. 2nd Lieut. (on prob.) C. J. Thompson, Gen. List; Temp. 2nd Lieut. C. S. Hall, Gen. List; Lieut. E. A. Thomas, Lan. R.G.A. (T.F.); Lieut. F. Billinge, Manch. R., S.R., from a Flying Officer (Ob.), with seniority from May 27th; Lieut. D. W. Davis, Can. Gen. List; 2nd Lieut. (Temp. Lieut.) P. F. J. Kent, 3rd Dn. Gds., from a Flying Officer (Ob.), with seniority from May 1st; 2nd Lieut. A. B. Dees, R. W. Surr. R. (T.F.); 2nd

Lieut. D. S. Kennedy, S.R.; 2nd Lieut. (Temp. Lieut.) J. H. B. Wedderspoon, Lowland Divl. Ammn. Col., R.F.A. (T.F.); Nov. 16th. Nov. 17th: 2nd Lieut. (on prob.) C. J. Pile, R.F.A., S.R., from a Flying Officer (Ob.), with seniority from July 28th; Temp. 2nd Lieut. (on prob.) C. D. Smart, Gen. List; Nov. 18th. 2nd Lieut. (Temp. Capt.) H. L. H. Owen, Dorset R. (T.F.), from Adjt.; Temp. 2nd Lieut. A. Binnie, R. Sco. Fus.; 2nd Lieut. A. L. Pattinson, S.R.; 2nd Lieut. R. W. Farquhar, S.R. Nov. 22nd: 2nd Lieut. R. W Buswell, Ches. Yeo. (T.F.); Temp. 2nd Lieut. (on prob.) R. Smith, E. Surr. R., and to be transfd. to Gen. List; 2nd Lieut. W. H. Markham, Manch. R., and to be secd. Nov. 23rd: 2nd Lieut. (Temp. Lieut.) F. W. W. Wilson, L'pool R. (T.F.); Temp. 2nd Lieut. (on prob.) P. Francis, Gen. List; Temp. 2nd Lieut. R. J. Rankin, Gen. List.

Memoranda.—E. C. Richardson to be Temp. 2nd Lieut. for duty with R.F.C.; Oct. 11th. Flight-Sergt. A. W. Armstrong, from R.F.C., to be Temp. 2nd Lieut. (on prob.) for duty with the Mil. Wing of that Corps; Nov. 15th.

Supplementary to Regular Corps.—The under-mentioned 2nd Lieuts. to be Lieuts.:—Nov. 1st: G. Barrett, N. H. Read, E. A. B. Rice, J. L. Finney, (Temp. Capt.) H. Tomlinson, M.C., S. J. Sibley, F. G. M. Williams, H. M. Fulton, N. Turner, W. A. Harvey, R. A. Courtney, W. O. Russell, A. W. Kilgour, (Temp. Capt.) E. G. Landon, V. P. Cronyn B. Mott. (Temp. Capt.) F. H. Songhurst, W. T. W. Wartnaby, A. N. Buchanan. 2nd Lieut. (on prob.) J. F. C. Bell resigns his commission; Dec. 9th.

London Gazette Supplement, December 9th.

Flight-Commanders.—And to be Temp. Capts. whilst so employed: Temp. Lieut. C. B. Cooke, Gen. List, from a Flying Officer; Sept. 27th. Temp. Lieut. S. A. Meller, Gen. List, from a Balloon Officer; Oct. 24th. From Flying Officers, and to be Temp. Capts. whilst so employed: Lieut. W. D. M. Bell, M.C., S.R.; Oct. 25th. Temp. Lieut. W. J. Y. Guilfoyle, Gen. List; Oct. 27th. Nov. 22nd: 2nd Lieut. (Temp. Lieut.) G. W. Hodgkinson, County of London Yeo. (T.F.); Temp. Lieut. E. C. Emmett, Gen. List; Temp. Lieut. J. Clisdal, Gen. List; Temp. Lieut. W. W. Carey-Thomas, Gen. List.

Flying Officers.—Temp. 2nd Lieut. J. F. Alcock, Gen. List, from a Flying Officer (Ob.); Oct. 29th, with seniority from Aug. 25th. 2nd Lieut. F. J. Tanner, Welsh Horse Yeo. (T.F.); Oct. 30th. Nov. 15th: Major S. A. Hargraft, 90th Canadian Inf. Bn.; Lieut. (Temp. Capt.) H. Steward, 6th King Edward's Own Cav., Ind. Army; Temp. 2nd Lieut. (Temp. Lieut.) H. L. Lascelles, Gen. List, from a Flying Officer (Ob.), with seniority from April 1st; 2nd Lieut. (on prob.) R. T. C. Hoidge, R.G.A., S.R.; Temp. 2nd Lieut. A. Pascoe, Gen. List; 2nd Lieut. W. H. Ruxton, R. Ir. Regt., S.R., and to be secd.; Nov. 17th. Temp. 2nd Lieut. A. J. Salton, Gen. List; Nov. 20th. 2nd Lieut. C. A. M. Furlonger, S.R.; Nov. 21st. Nov. 22nd: 2nd Lieut. J. B. Fenton, Middx. R. (T.F.); Temp. 2nd Lieut. F. W. Deane, R. Ir. Rif.; 2nd Lieut. (on prob.) B. Gaskin, S.R.; Temp. 2nd Lieut. C. R. Lamrock, Gen. List; Temp. 2nd Lieut. G. H. S. Cregeen, Gen. List; 2nd Lieut. (on prob.) H. T. Lydford, S.R. Nov. 23rd: Temp. 2nd Lieut. E. J. Pascoe, Gen. List; Temp. 2nd Lieut. H. T. O. Windsor, R. Muns. Fus., and to be transfd. to Gen. List; 2nd Lieut. (on prob.) A. C. Reeves, S.R.; 2nd Lieut. T. O. Clogstoun, R. War. W., and to be secd.

Equipment Officers, 1st Class.—And to be Temp. Capts. whilst so employed:—Nov. 17th: Lieut. R. P. J. M'Coy, S.R., from the 3rd Cl. 2nd Lieut. (Temp. Lieut.) N. Turner, S.R., from the 2nd Cl.

Equipment Officers, 2nd Class.—From the 3rd Cl.:—Nov. 17th: Lieut. (Temp. Capt.) J. B. Bowen, Pembroke Yeo. (T.F.); Lieut. G. G. Lever, R. Fus., S.R. From the 3rd Cl., and to be Temp. Lieuts. whilst so employed:—Nov. 17th: 2nd Lieut. W. Boag, S.R.; Temp. 2nd Lieut. A. L. Wilson, Gen. List; Temp. 2nd Lieut. E. E. Castle, Gen. List. Lieut. S. Ransom, S.R., from the 3rd Cl.; Nov. 19th.

London Gazette Supplement, December 11th.

Flight-Commanders.—From Flying Officers, and to be Temp. Capts. whilst so employed: 2nd Lieut. (Temp. Lieut.) A. L. Macdonald, M.C., R. Highrs.; Sept. 14th. Temp. Lieut. H. V. Stammers, Gen. List; Sept. 19th.

Flying Officers.—Capt. R. Bell-Irving, 29th Can. Inf. Bn.; July 20th. (Substituted for the notification in the *Gazette* of Aug. 17th.) Nov. 21st: Temp. Lieut. F. D. Stevens, Gen. List, from a Flying Officer (Ob.), with seniority from June 21st. 2nd Lieut. (Temp. Lieut.) T. S. Roadley, S. Staff. R., S.R., from a Flying Officer (Ob.), with seniority from June 21st. 2nd Lieut. C. P. Thornton, L'pool. R., S.R., and to be secd.; 2nd Lieut. (on prob.) A. L. Constable, S.R. Temp. 2nd Lieut. C. C. Sharp, Hamps. R., and to be transfd. to Gen. List; Nov. 23rd.

Equipment Officers, 3rd Class.—Capt. J. H. Jackson, ret. List; Oct. 31st. 2nd Lieut. A. Burgess, S.R.; Nov. 24th.

Memoranda.—The under-mentioned to be Temp. Lieuts. whilst serving with R.F.C.:—Aug. 1st: 2nd Lieut. R. Collis, E. Surr. R.; Temp. 2nd Lieut. E. L. Hyde, Temp. 2nd Lieut. R. C. Bryant, Temp. 2nd Lieut. F. D. Jackson, Temp. 2nd Lieut. E. L. Roberts. 2nd Lieut. (on prob.) E. Christmas, from R.F.C., S.R., to be Temp. 2nd Lieut. on Gen. List for duty with R.F.C.; Nov. 24th.

Royal Flying Corps (Territorial Force).

London Gazette Supplement, December 6th.

Hampshire Aircraft Parks.—The announcement of the seconding of 2nd Lieut. (Temp. Capt.) W. S. Farren, which appeared in the *Gazette* of Nov. 7th is cancelled.

London Gazette Supplement, December 9th.

Hampshire Aircraft Parks.—2nd Lieut. (Temp. Lieut.) F. A. Short to be Temp. Capt.; Nov. 1st. The under-men-

In the Mediterranean with the British Naval Forces.—A grotesque design decorating one of the aeroplanes of the R.N.A.S.

tioned 2nd Lieuts. to be Temp. Lieuts. :—Nov. 1st: H. Medcalf, R. Harrison, G. S. Wilkinson.

Aeronautical Inspection Department.

London Gazette, December 8th.

Lieut. G. B. Bulman, R.F.C., S.R., to be Temp. Capt. (without the pay and allowances of that rank) whilst employed as an Inspector, A.I.D.; Oct. 1st.

London Gazette Supplement, December 11th.

The under-mentioned Temp. Hon. Lieuts. to be Temp. Hon. Capts. whilst employed as Inspectors, A.I.D.; Nov. 1st. A. A. Ross, H. P. Philpot, G. S. Walpole. The under-mentioned to be Temp. Hon. Lieuts. whilst employed as Asst. Inspectors, A.I.D. :—Nov. 1st: A. R. Howard, F. D. Scott, W. S. Smith, A. Chapman, R. J. Grant, P. R. Callard, P. C. Thornton, A. J. Simpson.

Schools of Military Aeronautics.

London Gazette Supplement, December 11th.

Chief Instructors (graded as Squadron Commanders).—From Flight-Comdrs. and to be Temp. Majors whilst so employed: Lieut. (Temp. Capt.) L. W. F. Turner, S.R.; Oct. 1st. Capt. A. H. Jackson, Notts. and Derby. R.; Oct. 25th.

Instructors.—Graded as a Flight Comdr.: 2nd Lieut. (on prob.) (Temp. Lieut.) G. J. Read, N. Staff. R., S.R., from a Flying Officer, and to be Temp. Capt. whilst so employed; Sept. 19th. Graded as an Equipment Officer, 2nd Cl.: Capt. V. O. Rees, Lond. R. (T.F.), from an Equipment Officer, 3rd Cl.; Oct. 1st.

Examining Officer (graded as an Equipment Officer, 2nd Class).—Temp. Capt. T. E. Gilmore, Gen. List, from an Equipment Officer, 3rd Cl.; Sept. 19th.

HONOURS.

Egyptian Honour for R.N.A.S. Officer.

IT was announced, on December 5th, that the King had granted authority for the wearing of the following decoration: Fourth Class of the Order of the Nile (conferred by the Sultan of Egypt) :—

Squadron Commander C. J. L'E. MALONE, R.N.

More Rewards for the R.F.C.

IN a special supplement to the *London Gazette*, issued on December 11th, the following appeared :—

His Majesty the King has been graciously pleased to approve of the appointments of the under-mentioned officers to be Companions of the Distinguished Service Order in recognition of their gallantry and devotion to duty in the field :—

2nd Lt. A. G. KNIGHT, M.C., R.F.C.

For conspicuous gallantry in action. He led four machines against eighteen hostile machines. Choosing a good moment for attack, he drove down five of them and dispersed the remainder. He has shown the utmost dash and judgment as a leader of offensive patrols.

His Majesty the King has been graciously pleased to confer the Military Cross on the under-mentioned officers and warrant officers in recognition of their gallantry and devotion to duty in the field :—

2nd Lt. (Temp. Lt.) D. D. G. HALL, York. R. and R.F.C.

For conspicuous gallantry in action. He has flown in the worst of weather and often at very low altitudes. On one occasion he flew very low under a heavy fire from the ground, in order to range our artillery.

2nd Lt. (Temp. Capt.) H. JAMESON, R.F.C.

For conspicuous gallantry in action. He attacked a hostile kite balloon under very heavy fire. Later his machine descended to within 150 ft. of the ground, when he got the engine going again, and recrossed our lines at 1,300 ft. and returned safely. He has on many occasions done fine work.

Temp. Lt. R. JOHNSTONE, Gen. List and R.F.C.

For conspicuous gallantry in action. He has shown marked courage and initiative in turning our artillery on to columns of enemy infantry. On one occasion he carried out counter battery work in cloud and mist at 800 ft. under heavy fire from the ground.

Lt. R. J. LOWCOCK, Notts and Derby R. and R.F.C.

For conspicuous gallantry in action. He beat off an attack by four enemy machines and continued his ranging. Later, he flew under 1,000 ft. in a zone full of shells, in order to silence hostile batteries.

Capt. C. MACKAY, Leins. R., Spec. Res., and R.F.C.

For conspicuous gallantry in action. In very unfavourable weather he obtained most valuable photographs of the enemy's position. He fought four hostile machines for ten minutes, until assistance arrived and they were driven off; afterwards he continued his work with the artillery.

Temp. 2nd Lt. H. A. PEARSON, R.F.A. and R.F.C.

For conspicuous gallantry in action. He flew with another officer under 1,000 ft. in our shell zone in order to silence hostile batteries. He has rendered the most valuable services throughout as an artillery observer.

The under-mentioned has been awarded a bar to his Military Cross for subsequent acts of conspicuous gallantry :—

2nd Lt. (Temp. Capt.) J. O. ANDREWS, M.C., R. Scots and R.F.C.

For conspicuous gallantry in action. He showed great courage and determination in leading successful patrols and attacks on hostile aircraft, and has now accounted for his ninth machine. On one occasion he followed a machine down to 800 ft., on another he went down to 500 ft. (The Military Cross was awarded in *London Gazette*, dated October 20th, 1916.)

His Majesty the King has been graciously pleased to approve of the award of the Distinguished Conduct Medal to the under-mentioned non-commissioned officer for acts of gallantry and devotion to duty in the field :—

3464 Sergt. B. ANKERS, R.F.C.

French Honours for the R.F.C.

IN a special supplement to the *London Gazette*, issued on December 10th, it was announced that the President of the French Republic has bestowed the decoration "Croix de Guerre" on the under-mentioned officers and non-commissioned officers, in recognition of their distinguished service during the campaign :—

Major SIDNEY SMITH, R.F.A. and R.F.C.
Capt. (Temp. Major) THOMAS W. C. CARTHEW, D.S.O., Bedford Regt. and R.F.C.
Lieut. (Temp. Capt.) V. S. BROWN, R.F.C. Spec. Res.
Second Lieut. (Temp. Lieut.) MALCOLM HENDERSON, D.S.O., Seaforth Highrs. and R.F.C.
3192 Corp. ARTHUR WINTERBOTTOM, late R.F.C.

More Military Medals for the R.F.C.

IT was also announced, on December 10th, that His Majesty the King has been graciously pleased to award the Military Medal for bravery in the field to the under-mentioned non-commissioned officers and men :—

839 Sergt. W. BEARD, R.F.C.
17518 Actg.-Corpl. F. FROOM, R.F.C.
10720 Second Air-Mech. B. HARRISON, R.F.C.
19723 Second Air-Mech. D. P. HEPBURN, R.F.C.
892 Flight Sergt. J. B. MCCUDDEN, R.F.C.
19101 First Air-Mech. L. C. ROBERTS, R.F.C.
S.R. 7. Corpl. C. WILLS, R.F.C.

Air Work at Salonica.

IN the despatch from Lieut.-General G. F. Milne, C.B., D.S.O., commanding British Salonica Army, dated October 8th, describing the operations in the summer and early autumn, it is mentioned that several bombing raids were carried out by the R.F.C. Later, General Milne says: "The Royal Flying Corps, in spite of the difficulties which they had to overcome and the great strain on their resources, rendered valuable assistance."

Among the names of those officers and non-commissioned officers whose services General Milne considers deserving of special mention, are the following :—

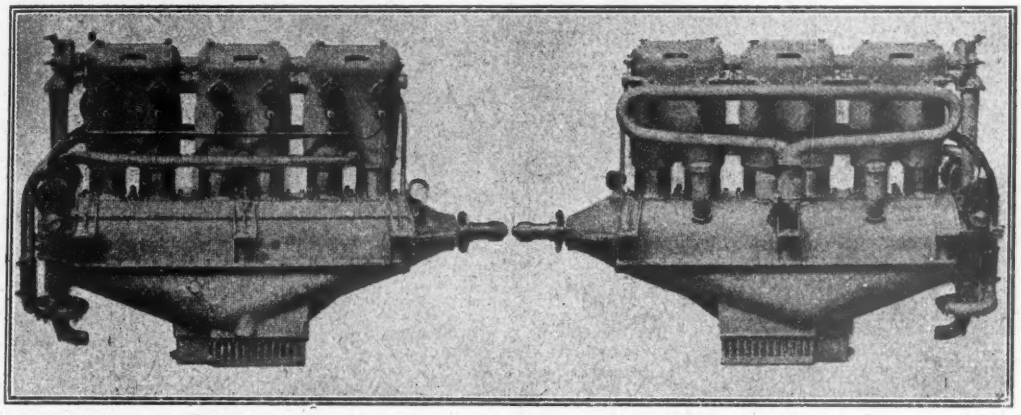
R.N.A.S.: Capt. (Temp. Major) C. F. Kilner, D.S.O., R.M.
R.F.C.: Major (Temp. Lieut.-Col.) G. W. P. Dawes, R. Berks R.; Capt. F. Hudson; Lieut. O. I. Preston, Notts and Derby R.; Temp. 2nd Lieut. (Temp. Lieut.) G. W. M. Green; 2nd Lieut. (Temp. Lieut.) H. G. Thornton, North'n R.; No. 198 Sergt.-Major F. Whilton; No 2169 Sergt. F. Dorsey.

FLIGHT

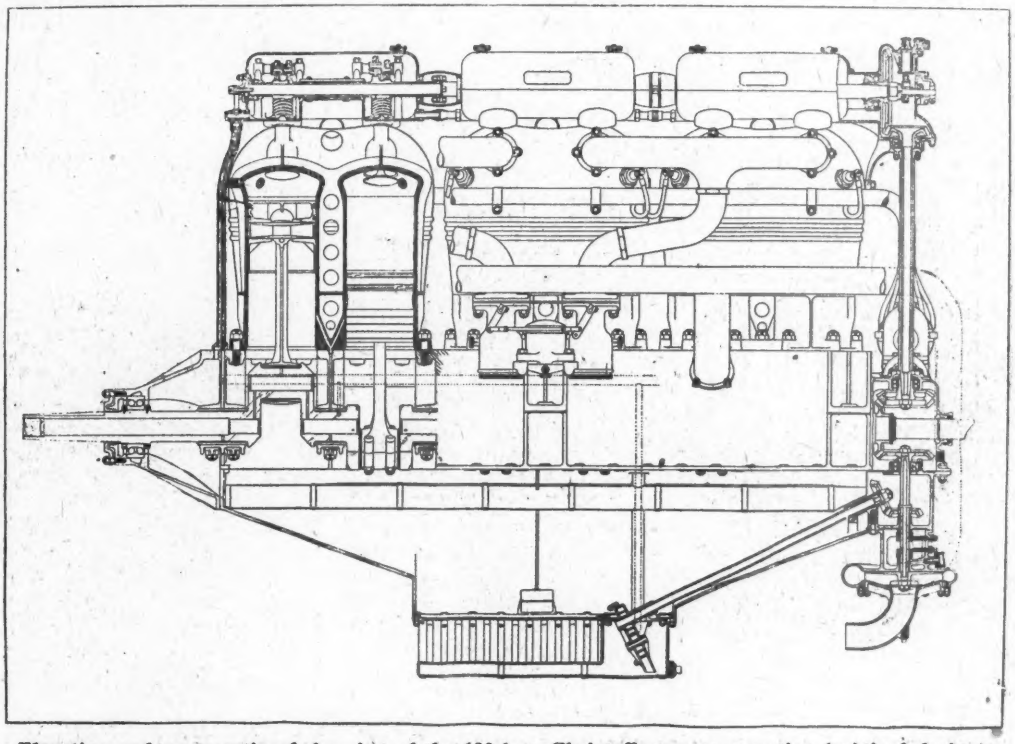
SOME AMERICAN AERO ENGINES.

THE 120 H.P. CHRISTOFFERSON.

AFTER having undergone extensive preliminary tests, a new 120 h.p. 6-cylinder vertical water-cooled aero engine was recently put on the market by the Christofferson Aircraft Co., of Oakland, Cal., U.S.A., and among the most interesting features are the overhead camshaft and the lubrication system. The cylinders, with a bore and stroke of $4\frac{3}{4}$ ins. and 6 ins. respectively, are of steel, containing 75 per cent. carbon and $3\frac{1}{2}$ per cent. nickel, having a tensile strength of 73·6 tons per sq. in. Each pair of cylinders has one water jacket of ample proportions, the jackets being of aluminium. The valves are of tungsten steel, $2\frac{3}{8}$ ins. diameter, and are located in the cylinder head, one on each side. They are actuated by a single overhead camshaft driven from the crankshaft by a vertical shaft and bevel gear. The camshaft is divided into three sections, one for each pair of cylinders, and is so connected that one or other of the pairs of cylinders can be removed complete without interfering with the other sections.



Two side views of the latest 120 h.p. Christofferson aero engine.

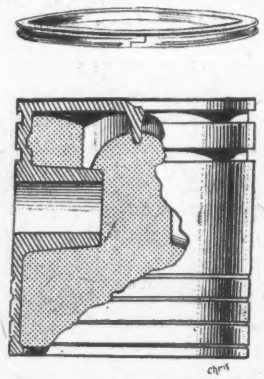


Elevation and part sectional drawing of the 120 h.p. Christofferson aero engine (original design).

The whole of the camshaft and valve gear is totally enclosed by an extension of the water jacket, and is constantly sprayed with oil. At the driven end of the camshaft is a small air pump, operated by a ball-bearing eccentric, which supplies air pressure for the petrol feed.

The pistons are of "Aloyanum," an aluminium alloy having an ultimate strength of about 18 tons per sq. in., and each weigh 1¾ lbs. They are fitted with two Burd high compression rings, and grooves are formed on the lower portion of the walls. The connecting rods are I section made from chrome vanadium steel, the tensile strength of which, when heat treated, is 100 tons per sq. in. Seven main bearings support the crankshaft, whilst the thrust, in either direction, is taken by a double row Heso-Bright ball-bearing mounted next to the propeller. This latter bearing may easily be adjusted by removing the lower portion of the crankcase end. Each main bearing is 2⅛ ins. diameter. Quite an important feature consists of the propeller flange, which can be detached from the motor with the greatest of ease. The crankcase is of Aloyanum, and is horizontally divided so that when removed the crankshaft is easy of access. The cooling water is circulated by a centrifugal pump driven off the end of the crankshaft.

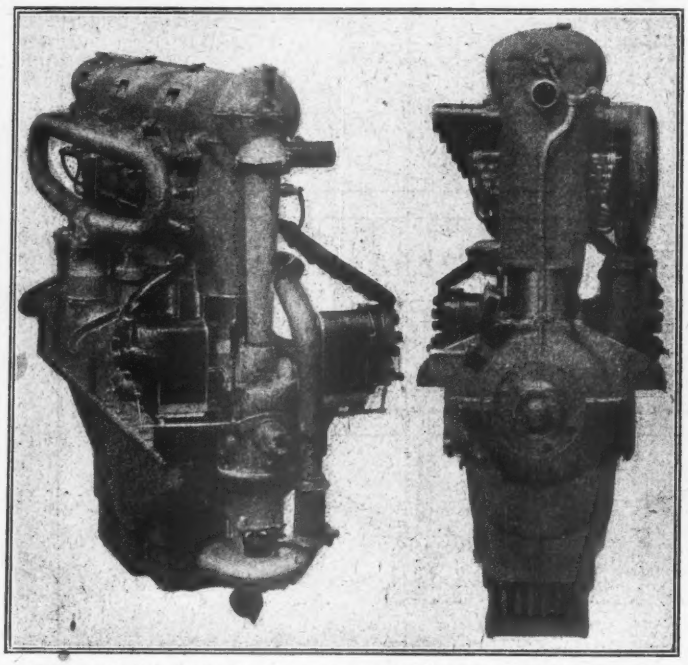
Ignition is by two Bosch magnetos driven off the lower bevel of the vertical shaft that drives the camshaft. There are two plugs to each cylinder, and these are located immediately under the valves.



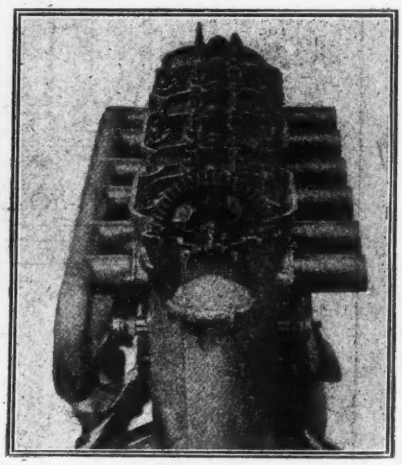
Sketch of the piston and ring of the 120 h.p. Christofferson aero engine.

Lubrication is forced throughout, the oil being drawn from the sump and forced by a gear pump, driven off the water pump shaft, through passages formed in the crankcase to all the crankshaft bearings and through the hollow crankshaft to the big ends, thence up the connecting rods to the gudgeon pins. Ducts also lead oil from the main passage to the cylinder walls, whilst oil is delivered to the cams and camshaft by way of a pipe at the end of the engine. Oil from the camshaft case drains back to the crankcase through a larger pipe, within which is the feed pipe just referred to, and also down the tube containing the vertical shaft driving the camshaft. All the gears are thus well lubricated. Before passing from the crankcase to the sump the oil flows through a cooling radiator, which will be seen at the bottom of the crankcase in the accompanying illustrations. A by-pass at the side of the crankcase enables the oil pressure to be regulated from 10 to 100 lbs. A double Miller or Zenith carburettor is fitted, the mixture being conveyed to the cylinders by the curious loop-form induction pipe shown in the side view. The weight of this engine complete, but not including exhaust pipe and propeller flange, is 511½ lbs., giving a weight per h.p. at 1,400 r.p.m. of 4·26 lbs.

Tested last May by the technical committee of the Automobile Club of America, one of these engines gave the following results:—The test for h.p., fuel consumption, &c., showed that 96·5 h.p. was developed at 1,199 r.p.m., 113 h.p. at 1,390 r.p.m., and 130·9 h.p. at 1,655 r.p.m., the fuel consumption at these speeds being ·68, ·68, and ·64 lb. per h.p. hour. The average speed during the 5 hrs. 15 mins. running was 1,449 r.p.m., the average h.p. 113·6, and the average petrol consumption was 9·4 gals. per hour.



Three-quarter and end views of the latest 120 h.p. Christofferson aero engine.



The overhead camshaft and valves of the latest 120 h.p. Christofferson aero engine.

The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

New Members.

IN accordance with the rules, the Annual Subscription of any New Member who is elected between November 1st and December 31st of this year, will cover the period up to December 31st, 1917.

Suspension of Entrance Fees of New Service Members.

Until further notice, Service Members will be elected to the Royal Aero Club without Entrance Fee.

New Club Premises.

The arrangements for the alterations, decorations, furnishing, &c., of the New Club House are in the hands of a special Committee, and the work is progressing very satisfactorily. There will be a billiard room, smoking lounges, buffet, reading and writing room, dining room and bedrooms. The house is situated within three minutes' walk of the present Club premises.

Annual Subscription.

In accordance with the resolution that was passed unanimously at the Special General Meeting of the Members held on the 27th July, 1916, "the subscription to the Club for the year 1917 and thereafter will be £5 5s."

THE FLYING SERVICES FUND
administered by
THE ROYAL AERO CLUB.

THE Flying Services Fund has been instituted by the Royal Aero Club for the benefit of officers and men of the Royal Naval Air Service and the Royal Flying Corps who are incapacitated on active service, and for the widows and dependants of those who are killed.

The Fund is intended for the benefit of all ranks, but especially for petty officers, non-commissioned officers, and men.

Forms of application for assistance can be obtained from the Royal Aero Club, 166, Piccadilly, London, W.

Subscriptions.	£	s.	d.
Total subscriptions received to Dec. 5th, 1916..	11,075	8	10
Officers at Royal Naval Air Station, Redcar ..	10	0	0
Collected at the Westland Aircraft Works, Yeovil (Sixtieth contribution)	0	13	4
Staff and Workers of Gwynnes, Ltd. (Twenty-eighth contribution)	9	0	10
Employés of Ruston, Proctor and Co., Aircraft Works (Fourteenth contribution)	3	0	0
Total, December 12th, 1916 ..	11,098	3	0

166, Piccadilly, W. B. STEVENSON, Assistant Secretary.

The Car.

No. 3, Clifford Street, New Bond Street, W. The new premises of the Royal Aero Club.

AVIATION IN PARLIAMENT.

Enemy Air-Raids and Reprisals.

MR. JOYNSON-HICKS, in the House of Commons, on December 4th, asked the Prime Minister whether, as an enemy aeroplane has now deliberately dropped bombs on the undefended parts of London, he will consider the desirability of giving definite notice to the enemy that on any recurrence we shall hold ourselves at liberty to bomb their towns by way of reprisal?

The Prime Minister: I do not think it desirable to give warning to the enemy of our intentions in this matter.

Aircraft Raid Insurance.

MR. BOYTON asked the Secretary to the Treasury whether, under the Government scheme of insurance against damage by aircraft, he has taken, or will take, the necessary measures to ensure that money paid under such insurance policies in satisfaction of damage done shall be expended on the insured premises in all cases where there are two or more interests, or that no person or the Government shall have power to recover their loss from any third person who may be under the usual lessee's covenants for repairs?

Mr. Runciman: My right hon. friend has asked me to answer this question. Special legislation of a difficult and contentious character would be required to give effect to the proposals made in the question, and as at present advised I cannot recommend legislation on these matters.

As far as the Government Aircraft Insurance Scheme is concerned, when a loss is paid the Government is subrogated to the rights of the insured against any other person primarily liable. Whether the Government would exercise those rights would depend upon the circumstances and equities of each case. Hitherto the Government have refrained from exercising those rights if the other person is uninsured.

A ROTARY SHAPING MACHINE FOR AIRCRAFT PROPELLERS, &c.

IT was in watching the operations with ordinary joiner's chisel and gouge, draw-knife and spoke-shave, that the inventor of the Rotary Shaping Machine was struck with

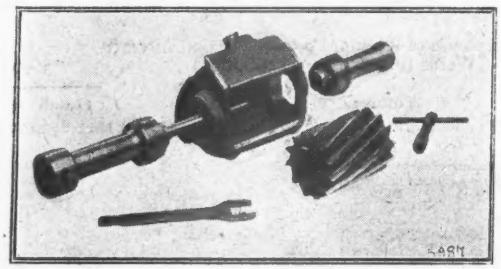


Fig. 1.—The parts of the apparatus dissembled.

the tediousness of the whole process, and was seized with the idea of introducing power for both the removal of the waste in bulk and the final shaping of propellers for aircraft.

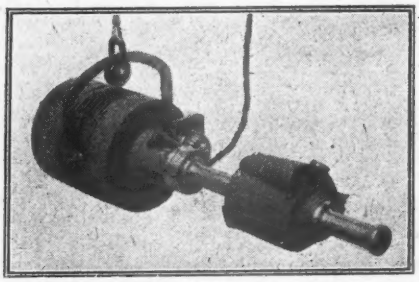


Fig. 2.—Motor drive. The funnel seen on top of the tool casing is for the ejectment of chippings.

Owing to the difficulty of working an aircraft propeller by machine, the shaping has hitherto been largely done by hand, and in order to have any chance of success the inventor saw that the machine would be required to impart the sensitiveness of the pressure of the human hand. This led him to think of a mobile rotary cutter, somewhat similar in principle to the hairdresser's rotary brush.

By reference to Fig. 1, it will be seen that the apparatus consists of a rotary cutter which revolves in a casing, handles being provided for holding and directing the tool, and the power being connected (through the handle at one end) in the shape of an electric motor, or through a flexible shaft to a pulley driven from the lineshaft. The tool used is of the milling cutter type, about 3 ins. in diameter by 4 ins. in length having about 12 teeth, which operate with a shear cut, the shear being arranged to drive the chippings obliquely

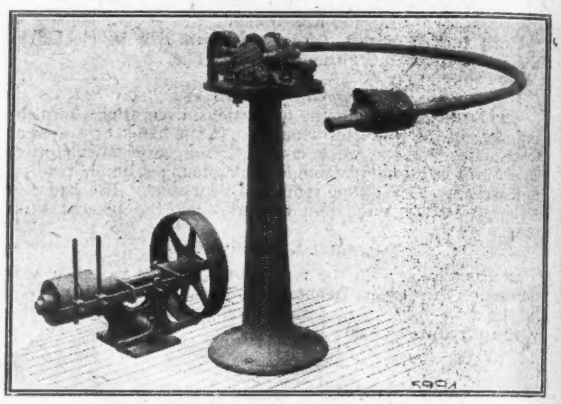


Fig. 3.—The Flexible shaft drive. Emery wheel for sharpening cutter mounted on standard.

in the direction of an outlet in the casing provided for the purpose. The casing is made of gun-metal and steel, as light as practicable. The opening seen in the casing is for the projection of the cutters, and it can be varied by means of the adjustable shutter or slide seen immediately above, this adjustment being required for regulating the depth of cut. The shutter is secured to the casing in side guides or slots. The outlet for the ejectment of the chippings is best seen in Fig. 2. It is funnel shaped, and arranged so that the chippings are delivered to the right-hand side of the operator,

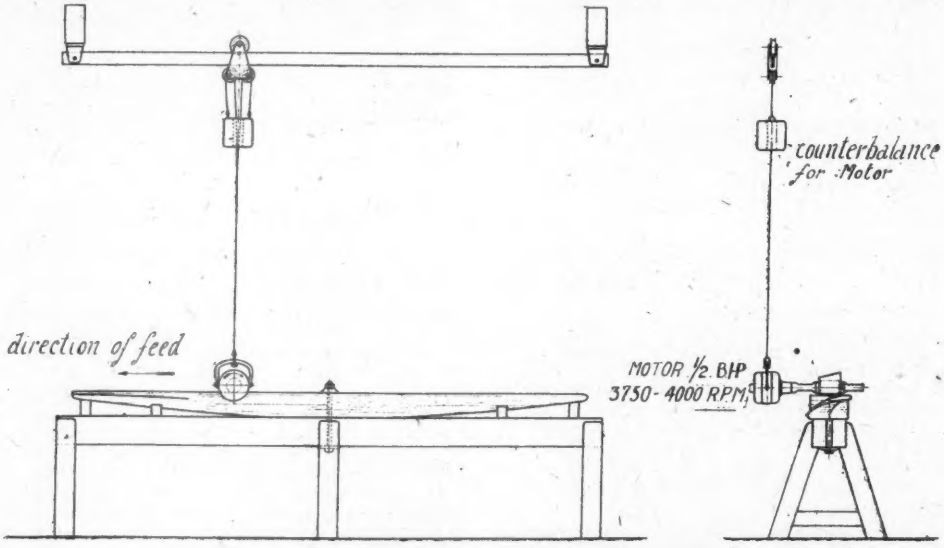


Fig. 4.—Showing direct motor drive arrangement.

and away from the driving shaft or motor. The cutter spindle is carried in self-aligning double-row radial-type ball bearings, the inner and outer races of which are secured in position by lock nuts. The cutter is easily removed from the machine by slackening two clamping screws, withdrawing the handles and spindle, and raising the adjustable slide. The ease with which this is done will be clearly seen by reference to Fig. 1.

Where electric current is available, undoubtedly the best drive is obtained by direct coupling a small high-speed motor, in the manner shown in Fig. 2, the motor being balanced as shown in the line drawing, Fig. 4. This arrangement is very

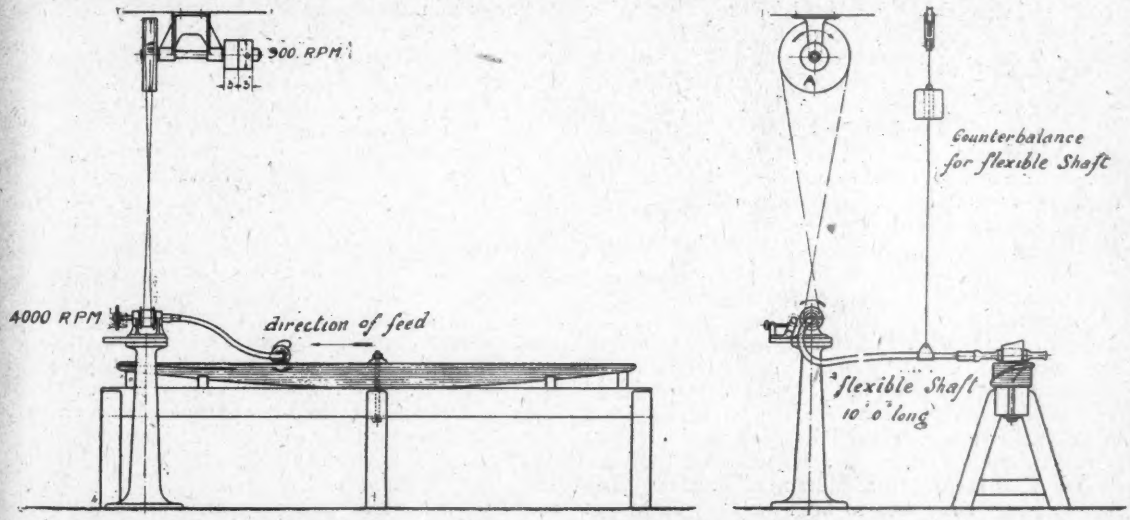


FIG. 5.—SHOWING THE FLEXIBLE SHAFT DRIVE ARRANGEMENT.—The countershaft, A, must be placed directly over the centre of the stand and drive by cross-belt as shown. Belt 1½ ins. wide.

efficient and workable, and eliminates the greater part of the wrist work experienced with the flexible shaft drive. The machine is connected to either motor or flexible shaft by means of a socket with bayonet joint, and a flexible coupling and spline shaft connect the spindle of either the motor or flexible shaft to the driving spindle of the cutter. If electrically driven, the motor can be run off any lighting supply.

The machine itself weighs about 12 lbs., exclusive of the motor or flexible shaft, but it is found quite unnecessary to balance this weight, as the latter provides just the steadying necessary and prevents all inclination to jumping as the tool performs the operation of cutting. The balancing arrangements shown in Figs. 4 and 5 are solely to take the weight of the motor or flexible shaft. In the case of the motor drive, the balancing arrangement, with its counterweight, is carried on a gantry rail, the length of the latter being to suit half the length of the longest propeller to be worked. A motor running about 3,750 revs. per minute, and giving ¼ b.h.p. continuously and 1 h.p. for short periods, is found ample to drive the machine, and the weight of such a motor is about 25 or 26 lbs.

In the flexible shaft drive (see Figs. 3 and 5), the shaft, which is about 10 ft. in length, is connected to a driving pulley running in ball bearings and supported on a stand, the bearings being arranged to swivel to give additional range to the flexible shaft. The pulley is 3¼ ins. diameter by 2½-ins. face, and runs at about 3,750 to 4,000 revs. per minute.

On an extension of the spindle which carries the driving pulley an emery wheel is mounted for sharpening the cutter, a hinged tool carrier or bar being bolted on to an extension of the pulley bracket and having a fine screw adjustment. The cutter is moved to and fro on the bar against an adjustable stop.

For sanding, the cutter may be replaced by a drum covered with sandpaper, but the tendency is to obtain a second machine for this purpose, as it is found in practice an advantage to have a larger casing for sanding.

The apparatus will rough out a two-bladed propeller in about two hours; the same work, we understand, takes about one day by hand labour.

The propeller is bolted to a low trestle or stand, enabling the operator to sit astride the work. A gauging table should be provided at the right-hand side, which should be suitably marked for guiding the operator to obtain the shape required.

As to how far the tool can be used for finishing the propeller depends upon the dexterity of the operator, but as a roughing-out tool it is no doubt a considerable acquisition in any aircraft factory.

Its use is not, of course, in any way confined to aircraft work, and its adaptability is almost as extensive as the joiner's spoke-shave on irregular work, especially for furniture requirements in shipbuilding, railway rolling stock construction, school and institute furniture manufacture, &c. It is also useful for flat planing floors, decks, &c. We understand that arrangements have now been made for Messrs. Thomas Robinson and Son to manufacture and market the Rotary Shaping Machine. Applications for further particulars should be sent to this firm.

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Women Workers for Aeroplane Workshops.

IN connection with an effort to raise the necessary funds for extensions of the school for training women welders, inaugurated by the Women's Service Bureau, a reception was held on December 5th at 5, Johnson Street, Notting Hill Gate, by permission of the Misses Woodward. The school at Notting Hill Gate now has 20 students, and has prepared over 100 skilled women for aeroplane workshops. Miss M. Lowndes explained that the necessity for the extension of the school was urgent, as the demand for the students exceeded the number that could be supplied with the present facilities. The hostesses of the afternoon were Lady Henderson, who presided, Lady Carden, Lady Loch and Mrs. E. L. Franklin.

◈ ◈

Austrian *v.* Italian Losses.

ACCORDING to the *Times*, on the Italian front during the last three months 20 Austrian machines have been brought down in aerial combats, whilst only four Italian aeroplanes have been lost.

A Much-Escaped German Pilot.

AFTER brief liberty of two days, Lieut. Otto Thelen, of the German Flying Corps, who escaped from the prisoners' camp at Holyport, Berks, was re-captured at Old Windsor on Sunday night On being captured, Lieut. Thelen said it was the third time he had got away, and he thought he must be unlucky. He had discarded his uniform for a brown suit, and had on him 5s. in English money, a map of London, a compass and chocolate.

ARMCHAIR REFLECTIONS

By the "Dreamer"

ONCE again the time has arrived for me to pen a few words of greeting to my readers. I wish, even as I expressed the same wish a year ago, that this time I could think that the season's greetings so easily spoken or written carried with them the possibility of being consummated to the full.

Unfortunately, this year as last, we have the one-time festive season upon us under conditions such as to make joy and merriment appear but hollow shells.

Some of us there are, no doubt, almost impossible as it seems, who have been little affected in that which touches them most closely. Some there are over whose house the dark angel has hovered with seeming unfair persistency, devastating once happy and prosperous families almost to the extent of extinction.

Just at a period when in times of sanity we should be thinking and preparing for the home-coming of those sons whose livelihood has called them away from the home fold, we are called upon to brace ourselves for the ordeal of bidding them goodby and God-speed on their way to fight for their King and country. Is it possible under such circumstances to wish the old wishes? Does "A Merry Christmas" sound blessingless—the reply a hollow mockery? I think not. I believe that with all the trouble and strife, with all the death and mutilation now rampant throughout the Empire, the old wishes have the same magic power, the reply the same loyalty, as ever.

I have offered my sincere good wishes so many times on this page in happier times, I feel I cannot let the season pass without the usual expression of good will, asking that one and all will accept that it comes from the very bottom of my heart.

If we cannot be entirely happy this Christmas season, as in days gone by, let us at least be as happy as we may, and hope that the time is not so very far distant when we may look upon life as not entirely composed of suffering and sorrow. Every cloud has a silvery lining, and although it may seem difficult to believe in justice and liberty at the present moment, let us believe, and be sure, that they will prevail when the Power that has the shaping of the world's destiny shall think fit and proper. In the meanwhile we are men and women of superior intelligence, and with the fortitude to suffer with equanimity when called upon by some power outside our influence.

Then there are the little ones to consider—those small personages who are so great, in that it will be to them this country will some day have to look for protection. Born into a world of sorrow, they happily are innocent at the moment of the understanding of that which goes to the making of turmoil and strife. Let them have their Christmas tree. Let that old impostor Santa Claus go his stealthy round of little cots, filling up little stockings with good things, the while rosy-faced boys and girls sleep with one eye open to defeat his admirable intentions. And if a tear should fall, as no doubt it will and should, at thoughts of long-past little stockings, and little boys grown big, try to comfort ourselves with the thought that this is as it must be—that this old world cannot stand still, that things must come and pass away, and be gone for ever. That even you who are so pleased to enact the old *rôle* of pleasure-bringer must some day bring sorrow at your passing. It is progress. It is evolution. It is life. So while we live, let us be happy as we may be. And so a Merry Christmas and a Happy New Year to one and all.

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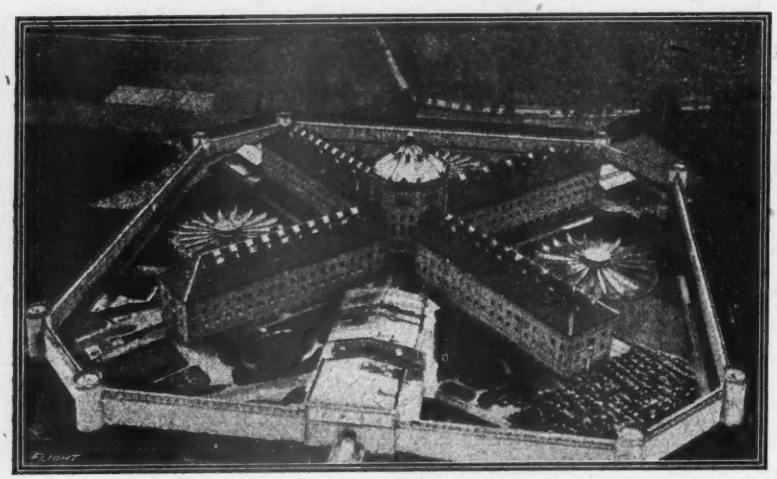
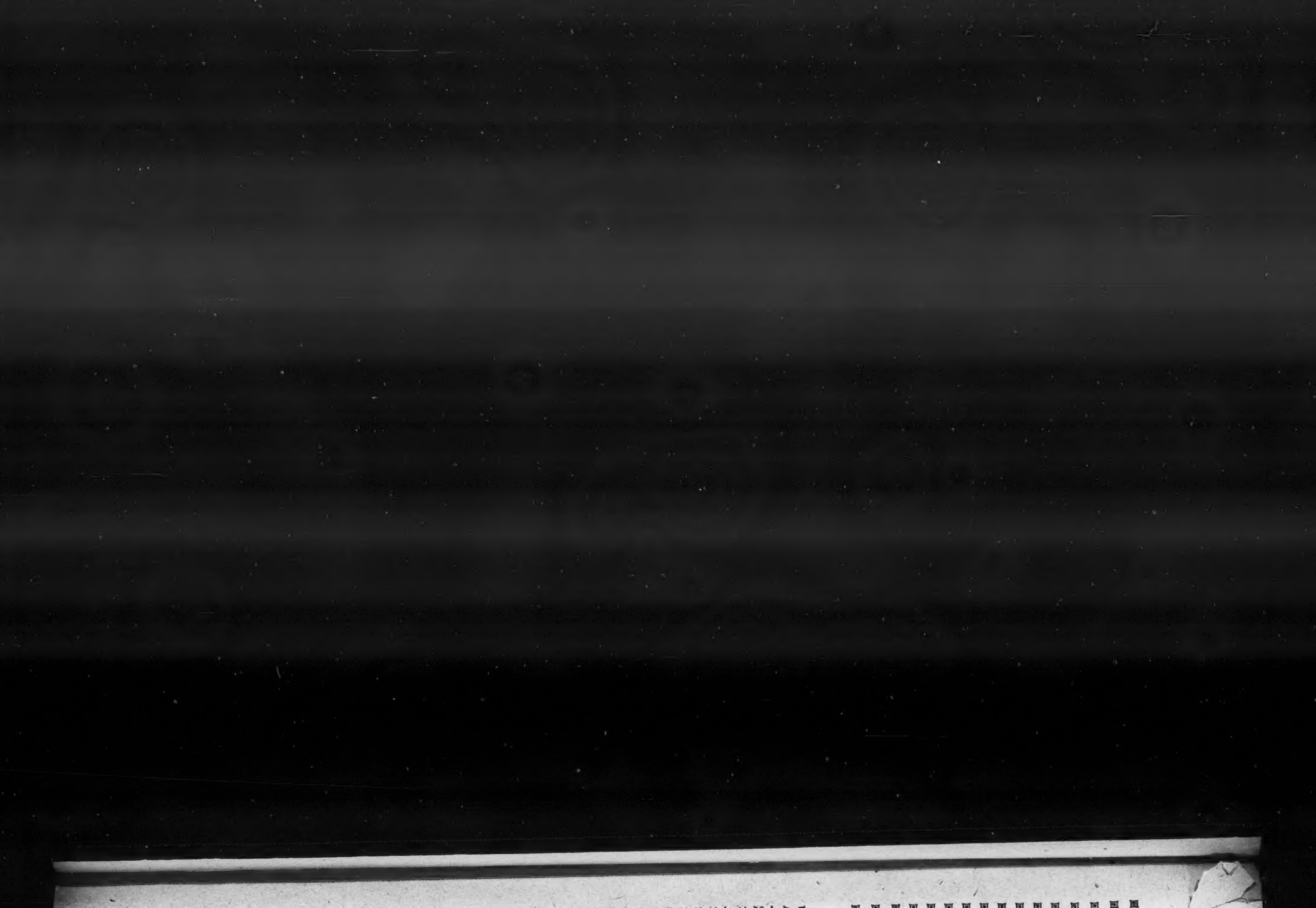


As seen from above, in the land of the Huns.—The Penitentiary at Bruchsal.



ANSWERS TO CORRESPONDENTS.

If in doubt about anything aviatic, write to "FLIGHT" about it.

J. W. T. (Eastbourne).

The earliest Zeppelin airships were designed so as to enable them to alight on the surface of the Lake Constance, over which the first trials were conducted. The gondolas were boat-shaped, and so designed that when the airship was barely buoyant, they supported part of the weight, and thus enabled the airship to rest lightly on the surface. It was found, we believe, that considerable difficulties with regard to trim cropped up, and in the latest type Zeppelins, even those employed for sea scouting, there is no attempt at any landing gear whatever. The gondolas have handling rails running along their sides close to the bottom, and when it is desired to effect a landing, this is accomplished by the landing crew, who first catch hold of the tow ropes, and later, when the airship is sufficiently low, of the handling rails, and guide the airship on to the trolleys and rails by means of which she is towed into her shed.

J. J. M. (Byfleet).

It is not possible to calculate exactly the drift coefficient of an actual machine from knowing its behaviour in the same manner that the lift coefficient can be estimated. With regard to lift, this coefficient can be estimated, since only the lift of the wings is considered. When it comes to the drift, however, not only the wings, but all the other parts of the machine such as body, undercarriage, struts, tail planes, &c., offer resistance, and one does not, therefore, know how great a portion of the resistance is due to the wings, and how much is detrimental head resistance. What can be done, however, is to estimate approximately how many square feet normal to the wind the total resistance of a given machine is equivalent to. For instance, suppose a machine is known to be fitted with an engine developing 100 brake h.p., and to fly at 100 m.p.h. The thrust developed, which must obviously be equal to the resistance, can be found approximately from the formula $T = \frac{550 \times H \times Ep}{V}$, where T = thrust in lbs., H = brake h.p. of engine, Ep = efficiency of propeller, expressed as a decimal, and v = the velocity in ft./sec. An efficiency of ·75 will be assumed, as this is a fair average. V = 100 m.p.h. = 146 ft./sec. We can then write: T = resistance = $\frac{550 \times 100 \times \cdot 75}{146} = 282 \cdot 5$ lbs. The resistance of a flat plate normal to the wind is found from the equation $R = kAV^2$, where R = resistance in lbs., A = area of plate in sq. ft., and V = velocity in m.p.h. k is a constant, the value of which varies somewhat with the size of the plate. We shall take as an average value of k 0·003. The equation can obviously be written, $A = \frac{R}{kV^2} = \frac{282 \cdot 5}{\cdot 003 \times 100^2}$ = 9·4 sq. ft. approx.

With regard to your second question, it is general practice to include the body in the parts inside the slip-stream, although, as you mention, the inner portion of the propeller arms, for a foot or so out from the boss, does not give any great amount of slip. The majority of *fuselages*, however, are considerably more than 2 ft. in depth, and engine cowls, where rotary engines are concerned, are usually of about 3 ft. diameter, or over. At any rate, there can be no doubt, that the *fuselage* does offer very considerably greater resistance at any speed than it would do had it been outside the slip-stream.

H. E. T. (Bradford).

There are very few figures available on which to base calculation of fin and rudder area. It is determined by the distance behind the centre of gravity of the machine, by the amount of side area of body, undercarriage, struts, wings (owing to dihedral), propeller, &c. It must be large enough to counteract the inherent yawing instability of the body and the yawing effect of the parts mentioned above that may lie in front of the centre of gravity. In his book, "Aeroplane Design," which we can thoroughly recommend, Mr. F. S. Barnwell, now Capt. R.F.C., suggests the following empirical formula: $C(s \times d) = S - \frac{S \times D}{2} + A$, where s = area of rudder in sq. ft., d = distance of centre of area of rudder from centre of gravity of machine, in ft., S = area of side elevation of body, aerofoils, landing gear, and propeller, in sq. ft., D = distance of centre of this area S *behind* the centre of gravity, A = area of wings, in sq. ft., and C = a constant, the value of which for tractors Mr. Barnwell gives as 1·7. Some designers place the tail plane of a "pusher" in line with the centre of thrust, while others prefer to have it some 6 in. above the line of thrust, the object of the latter disposition being, we believe, to partly counteract any effect due to the fact that the tail plane works in the down draught from the wings. So far as we are aware, the book you mention has not yet been published. The best books dealing with wing section and body resistance data are *Nouvelles Recherches sur la Resistance de l'Air*, by Mons. G. Eiffel, published by Dunod and Pinat, Paris, which can be obtained through "FLIGHT" offices at £2 5s., and the *Technical Report of the Advisory Committee for Aeronautics*, 1912–13, which can also be obtained from our offices at 10s. 6d., post free.

H. B. (Fareham).

1. Through the R.F.C. Cadet Corps. 2. Either. 3. You are hardly likely to get a commission unless you have had military experience. Apply to the Directorate of Military Aeronautics, Adastral House, E.C., for the necessary forms. 4. No. The R.F.C., if you are accepted, will train you.

J. E. (St. Albans).

The "wings" are only worn by a pilot who has passed all the tests. In your case therefore you would not be entitled to wear them.

Novice (Wood Green).

1. No; when on duty you must salute every officer (naval and military) senior to yourself. 2. Yes. 3. Some of the schools are controlled and some are not.

Contact (Richmond).

For the R.F.C., you should obtain the necessary form from the Directorate of Military Aeronautics, Adastral House, and for the R.N.A.S. from the Admiralty. You would probably have to wait another year, and in the meantime had better continue in your present position.

A. R. J. W. (Leytonstone).

There is no such book published. Vickers biplanes are mostly "pushers," but there are Vickers "tractors."

M. M. (Norfolk).

Space does not permit of giving the training in complete detail. You could obtain full particulars from Adastral House. Of the examples you give, the first officer is in the R.F.C., Special Reserve, having entered as a civilian; while the second is an Army officer, seconded from the Wiltshire Regiment to serve with the R.F.C. That also answers your fourth question.

F. W. L. (Ashford).

It is impossible to say definitely, as your sketch is not very clear. Apparently the machine is a large Sopwith. The attachment is a light skid to protect the ends of the planes when landing.

W. A. (Halifax).

1. First obtain commanding officer's permission, then get form from the Admiralty, and when filled up send it to the Director of Air Services, Admiralty, S.W. 2. No. 3. Not so far as we are aware. 4. It depends entirely upon himself.

C. E. S. (Gainsboro').

We can only suggest that you should write to Major Mitchell, The Polytechnic, Regent Street, London, W., giving full particulars and asking if there are any vacancies.

AIRISMS FROM THE FOUR WINDS

MUCH as the loss by fire of the Princess Theatre, Crayford, is to be deplored, its very destruction gives yet another opportunity for Messrs. Vickers to show their determination to cater for the wholesome recreation of their employees. The work of reconstruction was at once decided upon, and, moreover, the interest of Princess Christian, who laid the foundation stone and performed the opening ceremony of the original structure, is so personal in the welfare of the workers, that Her Royal Highness has already passed her word to repeat the ceremony the moment opportunity serves.

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THERE is just a small silver lining to the cloud—a café, which was part of the "theatre" scheme, was not included in the conflagration, and this is still available for its original functions.

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BY way of a first contribution to the Royal Aero Club Flying Services Fund, as a result of the royalty on sales of the book of the War Letters of the late Flight Lieut. Harold Rosher, R.N., entitled "In the Royal Naval Air Service," Messrs. Chatto and Windus, the publishers, have sent along a cheque for £50, and a like sum to Mrs. Murray Sueter's R.N.A.S. Comforts Fund.

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POSSIBLY, so as to be in active sympathy with the mishaps to the Zeppelin Airship raiders over here who never got back, Count Zeppelin himself has also, it is reported had another bad breakdown. *His*, fortunately for him, happened in the surroundings of his villa on the banks of Lake Constance. What, probably, has upset His Countship more than anything is the unkind, not to say brutal, things which certain Germanic newspapers have said as to the ineffectiveness of his pet air-strafers. His proud spirit is hardly likely to be touched by any consideration for the personal disaster element.

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THE Count should buck up, and look out for some good sport in the near future, by reason of the latest report from Paris, which credits our Allies with having devised an unpleasantly effective method of advancing the destruction of these air-pirates, almost to a certainty, once they get within range of this anti-"weapon." We are by way of thinking that we might lay in a stock this side also.

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LADY HENDERSON, the wife of Sir David Henderson, the Director-General of Military Aeronautics, is one of the most strenuous and practical leaders in war work for women. Last week Lady Henderson presided at the meeting of the Women's Service at the Oxy-Acetylene Workshop at Notting Hill Gate, and there was much enthusiasm at the remarkable progress achieved by the helpers in this particular employment. What would, we wonder, have been said a year or so back had it been even mooted that women should take up work of this character? Yet here we have the whole of the tricky operations being carried out by war working women, whose methods might well be studied closely by those who count themselves expert in this particular direction.

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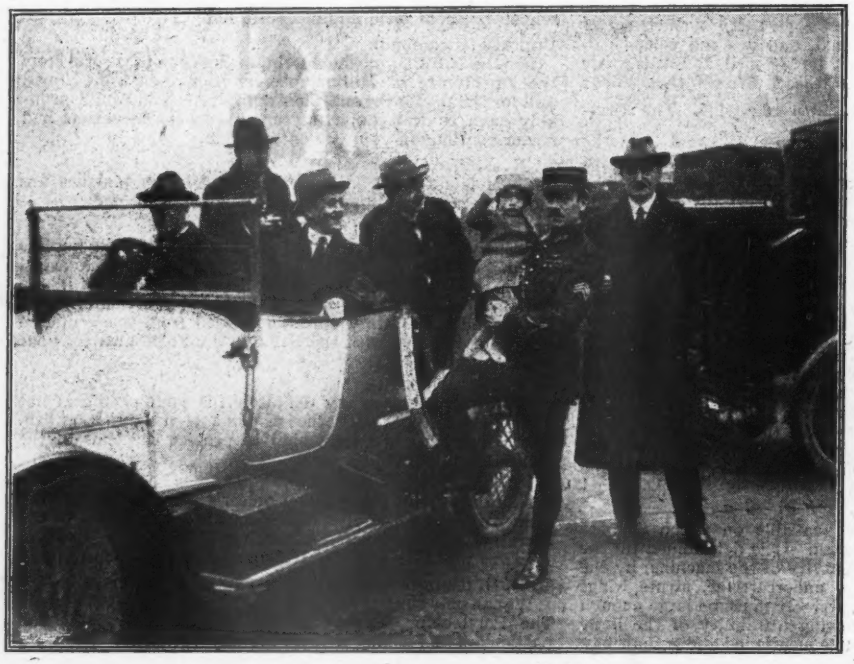
As might be expected, the much-discussed correspondence by Mr. Prevost Battersby in the *Observer* some little time ago, in which he suggested the cessation of all aircraft warfare in the future, has got across to Germany, where it is reproduced in an aviation journal. The article is headed "England's Fear of German Air Power." After printing Mr. Prevost Battersby's letter, and the article by "C.W.," in reply to it, the comment of the German paper is as follows: "This is probably the first time that England has so plainly acknowledged the superiority of German air power over English. Nobody shall fly, so long as anybody knows how to do so better than the English! Let all nations be lulled to sleep, and then at last England will fly better than anybody else. Then Mr. Battersby would be the first to shriek at the top of his voice, 'Of course, we must fly.' This is not the main thing, however, in the discussion in the *Observer*. Whatsoever may be the pros. and cons., the main thing is that they *are* discussed, and this fact,



Lieut. Louis Noel, of Salonica-Sofia-Bucharest fame, and the Hendon pilot of other days, amongst a few old friends at Charing Cross on Tuesday last, just before returning to his flying duties. He is holding his God-child, son of the late J. B. Manio.

therefore, discloses how deep the thorn of fear of German air raids has stuck in the flesh of the English people. Moreover, this discussion nullifies the denials of German successes in the air, as evidently the bombs hit something besides lonely ponds, ramshackle wooden sheds, and lame cab horses; and when the anti-aircraft defences of Lord French fail, the English are not ashamed to venture to add another to the already oft-repeated, multitudinous, terms of peace— which frequently border on insanity—that of prohibiting all flying."

For a nation that prides itself on having bred some superphilosophers, these comments show a curious lack of understanding of English psychology. Perhaps the writer has altered his views in the light of more recent happenings.

LIEUT. LOUIS NOEL left London last Tuesday for his native land, where he intends to spend the last few days of his short, but well-earned, rest prior to resuming his effective programme of Boche strafing. There was a small gathering of personal friends to see him off from Charing Cross, and wish him God-speed, and although "Our" Noel looked well and hearty, all felt that "another little rest wouldn't do him any harm," for he has had a hard time of it out at Salonica. Well, give them a good extra strafing this time, Louis, and hurry back again to us soon. By way of God-speed, we gave him a hearty wish on behalf of the whole of the readers of "FLIGHT" for a speedy and safe campaign.

IN case "P.B.'s" business man—or is he his own B.M.?—has not already received Lord Justice Darling's subscription to *The Imperialist*, he might send in his claim to lift the regulation eight shillings forthwith, to that end. We would suggest that a contract may easily be held to exist, upon formal acceptance of His Lordship's offer last week to counsel, in the Godfrey Isaacs-Marconi-Jackson blackmail case: "If you could show me a paper without advertisements, I would subscribe to it." It should be a certainty. As Lord Justice Darling in the same case showed his impartiality for acknowledging a "higher legal authority," we feel sure he will in the same sense accept our version in this case as to the law of contract, and at once help to swell *The Imperialist's* subscribers list, always provided His Lordship does not hold that the entire publication is but an advert. for P.B. himself. N.B.—Any legal como. attaching to this introduction, please credit to one of *The Imperialist* benefit funds.

IF you have tried recently to tie up a parcel with newspapers, perhaps you will be wondering with us what the exact proceeding was in the tying-up process of the two German officer prisoners of war, one of whom was Lieut. Otto Thelen, of the German Flying Corps—by themselves! The method adopted, as described, is not *very* convincing, but as the pair of adventurers appear to have got free, we can only conclude that they must be amateur rivals in a reverse sense to some of the knot untying experts, who flourished in places of entertainment a decade or so ago. At the official inquiry, the story runs that "the two officers hid themselves in a shed in the detention grounds in which waste paper was stored. They covered themselves up, and to get air used a stick of elderwood, from which they had removed the pith. The stick just emerged from the heap of paper. Late in the day two orderlies with barrows arrived at the shed to take the waste paper away. The officers went into the barrows, and were wheeled past the sentries to a place where they made their escape.

"The inquiry was adjourned."

And we're not surprised at it. An inducement to duplicate their performance before witnesses might be held out, in the form of a promise of mitigated punishment for their attempt to escape. There's money in it.

TEN YEARS AGO.

Excerpts from the "Auto." ("FLIGHT'S" precursor and sister journal) of December, 1906. "FLIGHT" was founded in 1908.

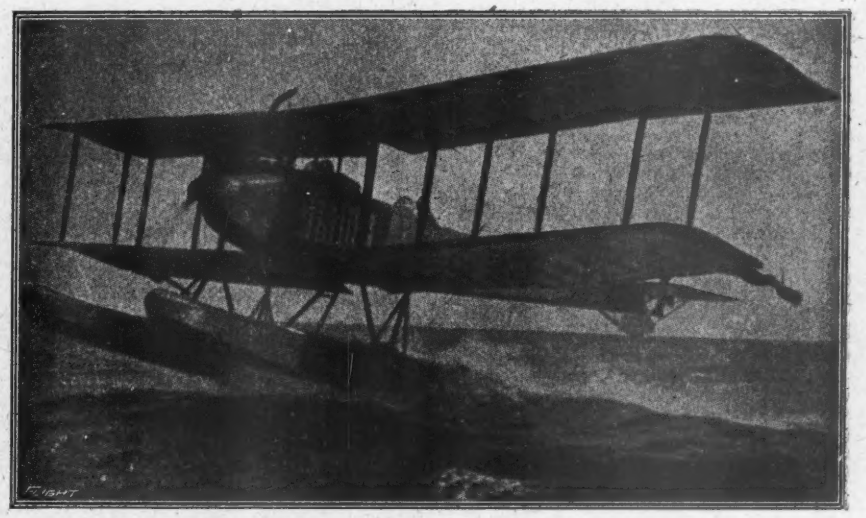
CONFIRMATION OF THE WRIGHT BROTHERS' CLAIM.

The leading event of the past week in connection with aeronautics is not perhaps in the strict sense of the word an event at all, but it is at any rate an occurrence of the very greatest general interest. We refer, it is almost needless to say, to the interview which a representative of the *Daily Mail* has had with one of the Wright Brothers, and apparently also with other persons in a position to give him reliable information regarding the negotiations which are going on, and are stated to be practically complete, between the two famous experimenters and the Government of the United States.

Among the most interesting of the remarks Mr. Orville Wright made was that managing the aeroplane was really no harder than riding a bicycle, and that he could teach any young man to do it within three days. He added that when control was obtained, the machine was quite devoid of danger, as that even when the engine stopped from any cause, one could always glide to earth easily and gradually, as occurred on one occasion when the motor was brought to a stop by a hot bearing. Though some distance away from the shed where it was housed, Mr. Wright was able to glide down at a small angle, and alight close to the shed door.

SUBSTANTIAL PRIZES FOR AEROPLANE MODELS.

The *Daily Mail* has added to its munificent offer of the £10,000 prize, £250 to be awarded in three prizes for working models of aeroplanes, to be exhibited at the Aero Club's exhibit of aeronautical appliances, Messrs. Cordingley's Motor Show at the Agricultural Hall, in the spring, when they will be practically tested by the Club. As pointed out by us editorially in drawing attention to the subject, this offer should have a very beneficial effect in stimulating invention and enterprise in design, and providing inventors with some, at any rate, of the sinews of war to enable them to carry their investigations further.



OFF!—A German (Gotha) seaplane starting on a reconnaissance flight. Note the long stepped floats which project backwards to a point considerably behind the pilot's seat.

Personals

Casualties.

Flight Sub-Lieutenant the Hon. ARTHUR CAMERON CORBETT, R.N., killed on service, whose death is announced, was the second son of Lord Rowallan and was born in March, 1898. He had seniority as flight sub-lieutenant of June 11th of this year. The elder son of Lord Rowallan, the Hon. Thomas Godfrey Polson Corbett, holds a commission in the Yeomanry.

Captain LESLIE OAKES CROWTHER, Flight Commander, R.F.C., who has been killed in action, was the second son of Mr. and Mrs. H. O. Crowther, of Broadclyst, Beckenham, Kent. Born in 1891, he was educated at St. Andrew's, Eastbourne, and Malvern College, afterwards spending for educational purposes two years in New York and Dresden. Captain Crowther joined the Royal West Kent Regiment in September, 1914, and in December, 1915, transferred to the R.F.C. For many months he had been stationed at the Front, where he engaged in many thrilling air fights and bomb-dropping expeditions.

Second-Lieutenant ARTHUR PATRICK DONNELL, Northumberland Fusiliers, attached R.F.C. (killed in an aeroplane accident on December 4th), was third son of the Rev. and Mrs. C. E. Donnell, Stamfordham Vicarage, Newcastle-on-Tyne. He received his commission in April of this year, and was appointed flying officer in the following July.

Second-Lieutenant DEREK SIVEWRIGHT JOHNSON, R.F.C., who was killed on December 4th, aged 21, was the youngest son of Colonel Frank Johnson, Royal Sussex Regiment, and of Mrs. Johnson, of Melrose House, Hove.

Lieutenant ERNEST CONWAY LANSDALE, A.S.C., attached R.F.C., is officially reported to have died whilst a prisoner of war. Aged 21 years, he was the elder son of Captain E. E. Lansdale, A.S.C., of Hawthorn Villas, The Grove, Ilkley. Lieutenant Lansdale was educated at Ilkley Grammar School, and was in Denmark when the war broke out.

Second-Lieutenant H. E. MARTIN, R.F.C., killed November 16th, age 23, was the youngest son of Mr. and Mrs. A. A. Martin, of Lower Addiscombe, Croydon. He took his pilot's certificate at Hendon in June this year, and was given a commission in the R.F.C. on August 1st. He obtained his wings early in September, and went to the Front on October 28th. He was an ardent motor cyclist, and well known in athletic circles.

Flight Sub-Lieutenant A. T. OSBORNE MANN, R.N.A.S. (killed in a flying accident on November 29th), was the second son of Mr. James Elliott Mann and Mrs. Mann, of Sydney, New South Wales. He was born in 1892, and educated at St. Ignatius College, Lane Core River, Sydney. He came to England in October, 1915, and obtained a commission in the Royal Naval Air Service. He took part in several raids and in attacks on Zeppelins.

Lieutenant J. M. J. SPENCER, R.F.C., who has been killed in action, was the second son of Mr. and Mrs. R. E. E. Spencer, Walbottle Hall, Newburn, Northumberland. Twenty years of age, he was educated at Alnmouth and Clifton College and was about to enter King's College, Cambridge, when war broke out. He enlisted as a gunner in the Northumberland Artillery, afterwards obtaining a commission in the Northumberland Fusiliers, receiving his second star in 1915. Lieutenant Spencer transferred to the Royal Flying Corps in July of this year, and went to the Front in September.

Lieutenant VICTOR STRAUSS, R.F.C., who has been killed in action, was the son of Mr. Arthur Strauss, head of the firm of A. Strauss and Co., tin and copper merchants, Rood Lane, E.C., who has represented the North Division of Paddington in the House of Commons since 1910, and who was formerly M.P. for the Camborne Division of Cornwall.

Flight-Commander THOMAS ATKINSON TILLARD, Yeomanry and R.F.C. (killed on active service on December 6th), was the younger son of the late Algernon Tillard and Mrs. Bonham Carter, of Adhurst St. Mary, Petersfield. Flight-Commander Tillard, who was thirty-two years of age, had his commission in the Yeomanry in October, 1914, and transferring to the Flying Corps, was gazetted flying officer in March of this year.

Wounded.

Second-Lieutenant CHARLES FRANCIS WOLLEY-DOD, Sherwood Foresters, attached R.F.C., wounded, is the second son of Mr. Francis Wolley-Dod, of Edge Hall, Chester, and was born in August, 1892. He got his commission in the regiment mentioned in May last year. The family of Wolley-Dod is a very ancient one. The founder of it, Cadwgan Dot, lived in the time of Henry II., who died in 1189, and his son Hova married the daughter and heiress of the Lord of Edge in Cheshire, obtained one-fourth of the manor, and settled there. His descendants have held the property ever since.

Married and to be Married.

The marriage arranged between CEDRIC R. ALSTON, South Lancashire Regiment, attached R.F.C., eldest son of Mr. and Mrs. Rowland Alston, of 96, West Hill, Sydenham, and MARGERY LILIAN, eldest daughter of Dr. and Mrs. H. M. STEWART, of Dyffryn, Dulwich, will take place quietly on January 2nd at St. Stephen's, College Road, Dulwich (Sydenham Hill Station, South-Eastern and Chatham Railway), at 2.30.

The marriage of Captain EMLEY, R.F.C., and Miss DOROTHY HORROCKS, Salkeld Hall, will take place at Addingham Church on December 28th, at 2 p.m.

On December 7th, ROBERT P. GRIMMER, the son of the late Robert Grimmer, of Wisbech, was married to IDA MARY HOWES, daughter of William Joshua Howes, of Norwich, at St. Martin's Church, West Ealing.

The marriage arranged between RONALD ST. CLAIR MCCLINTOCK, R.F.A. and R.F.C., and Miss MOLLY LAIRD will take place at 2.30 on December 20th, at the Church of the Holy Trinity, Kensington Gore, S.W.

Items.

It has been ascertained that Lieutenant A. J. EVANS, R.F.C., is a prisoner in Germany. Lieutenant A. J. Evans, who was "posted" as missing some time ago, won great distinction in cricket for Winchester, Oxford, and Hampshire. He was captain at Oxford in 1911.

Second-Lieutenant H. B. O. MITCHELL, M.C., R.F.C., officially reported missing, is now known to be a prisoner of war at Dusseldorf. He is the eldest son of Mr. and Mrs. Henry Mitchell, St. Winifred's, Coleraine, and was educated at Coleraine Academical Institution and Trinity College, Dublin.

Photographers for the R.F.C.

SKILLED photographers, with a thorough knowledge of developing, bromide printing, and enlarging, combined with sound technical knowledge and speed, are required for immediate service in the R.F.C. Applicants who possess the above qualifications and are fit for general service or garrison service abroad, should in the first instance apply in writing, enclosing copies of testimonials, to Mr. Hutchison, Central London Recruiting Depôt, Whitehall, London, S.W. They will be required to pass a trade test before acceptance. It should be noted that operators are not required.

A Japanese Pilot Killed.

LIEUT. K. HIGUCHI, a Japanese military pilot, attached to the Tokorozawa Aviation Corps, was killed on October 18th, soon after starting on a flight. He had reached a height of 2,500 metres, when his machine appeared to break, and crash to the ground. Four days before he had flown 250 miles.

Japanese Anti-Aircraft Training.

THE Japanese *Aeronautic World* states that the military authorities have recently acquired a plot of ground located in Kametsuri, Yama, Toyama prefecture, where soldiers will be trained in shooting at aeroplanes.

FLIGHT

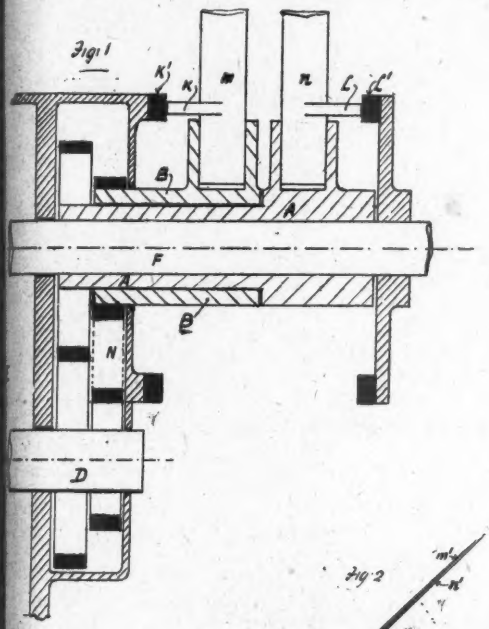
CORRESPONDENCE.

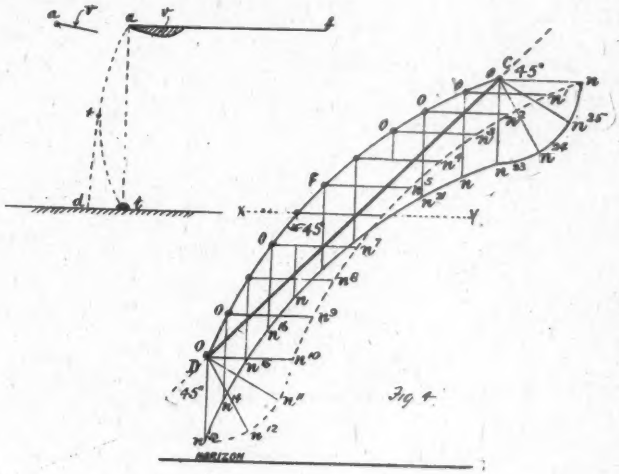
A Rotary Equivalent to Wing-Flapping.

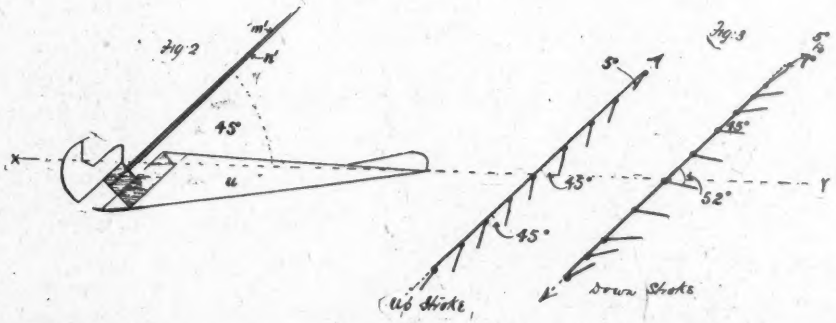
[1931] With reference to the note on M. Passat's wing-flapping machine, in your issue of September 14th. the bulk of experiment certainly appears to lie in detail improvement of existing design rather than in developing original types of machine, but I do not think the rapid reciprocation of artificial wing vanes is as yet practicable on full size machines; it is, of course, unnecessary since artificial wing mechanisms do not suffer from the limitation of arteries crossing the joint and can be made to flap by rotation as well as by reciprocation.

Two single-bladed or vaned propellers superimposed and rotating in opposite directions at equal speeds when correctly mounted and feathered will reproduce quite well the wing motion of the numerically largest class of wing-flappers—the insects.

The arrangement is broadly as follows:—A radial type engine E drives two tubular shafts *A* and *B*, Fig. 1, concentrically mounted on a fixed central shaft *F* which is







secured to the engine crank case. The crank-shaft *D* drives shaft *A* in one direction by a spur pinion, and shaft *B* in the opposite direction by a silent chain *N*. Two vanes or wings m^1 and n^1 are carried by wing spars *m* and *n* fixed so as to have axial movement in sockets on the shafts *A* and *B*. Each spar has a short lever arm, *K* and *L* respectively, the outer ends of which bear on corresponding cam plates K^1 and L^1. The steepness of the cams need not be more abrupt than 1 in 8. Attached to the cam plate L^1 is a body or fuselage (*u*, Fig. 2) of such leverage that when the said body is horizontal the engines, shafts, wings and cam plates are inclined at about 45 degrees from the horizontal, and the plane of rotation of the wings cuts the horizontal at about the same angle.

Starting with the two wings together (practically superimposed) at the highest position above the body, each wing makes a forward and downward stroke on one side of the body and then continues its movement as an upwards and backwards stroke on the opposite side of the body. The wings, therefore, cross at top and bottom of strokes. During their movement the wings are feathered by the passage of the lever arms over the fixed cams and in the following manner. Where the wings cross they are practically parallel to the plane of rotation and thus do not collide with one another, but as each wing moves on its downward stroke, Fig. 3, it is feathered with a gradual increase of inclination till at about half-way the vane is horizontal, *i.e.*, it has been feathered so that it is inclined at 45 degrees to the plane of rotation. At about ⅗ stroke the feathering is gradually decreased so that the vanes may again cross at the bottom of the stroke. On the up-stroke the vanes are feathered so that they are practically vertical on most of the stroke. The downward and forward stroke is therefore almost wholly a lifting stroke, and the upward and backward propels the machine. At the crossing points the wings are inclined at about 5 degrees to the plane of rotation, so that at both these parts of each revolution there is both lift and propulsion.

This general system of feathering may be inferred from the figure of 8 movement so characteristic of insect flight and from the following observations.

Let a flexible rod *ab*, having a vane *v*, be struck with uniform velocity vertically downwards at an object *t*, the vane being held at a small positive angle to the horizontal. The rod tip *a* will follow the path *ad* reaching the ground at a point *d* in advance of the object, the deflection being due to air reaction on the vane. If the rod be accelerated to maximum velocity at mid stroke *r* and have minimum velocity at *a* and *d*, the tip will follow a curved path, *a*, *r*, *t*, and a similar curve to this can be obtained at uniform velocity by feathering the vane as shown in Fig. 3 at different parts of the stroke.

The reciprocating wing of an insect corresponds roughly

to the vaned rod in having a maximum velocity and feathering at mid stroke, but the wing stroke is made downwards and forwards as *CD*, Fig. 4, and the path followed by the wing tip is similarly *CFD*. Then if *On* be the plane part of the wing, *O* being the leading edge and *n* the trailing edge all in section, the downwards and forwards stroke may be shown at various points as On, On^1, On^2 . . . On^{10}. On reaching this point, which represents the bottom of the stroke, the wing leading edge is momentarily almost at rest while the vane of the wing swings down to the position On^{13}, keeping the same vane angle to the line of stroke as on the down stroke, the up stroke is now made and various positions are shown at On^{14}, On^{13} . . . On^{22}, at which point the top of the stroke is reached and the leading edge halts while the vane swings through On^{24}, On^{25}, to the starting position *On*.

The vane of a wing therefore swings through an angle of 90 degrees in making a full up and down stroke, but the feathering described can only refer to a general form of insect wing motion, and the geometrical construction shown is in nature varied by the elasticity of the wing structure. If the path of the trailing edge *n* be followed through n^1 n^2 . . . n^{13}, and thence again to *n*, it will be seen that the trailing edge describes in space a figure of 8 which is due solely to the feathering employed and requires no special mechanism to produce.

In the rotary mechanism herein shown let one of the wings be feathered on the down stroke till it is horizontal. Then without any change of feathering the same wing on the up stroke will be vertical. Therefore to obtain a similar feathering on down and upstrokes to that described in Fig. 4 the maximum feathering angle is but 45 degrees. With both wings moving this angle as previously mentioned must be lessened to 5 degrees at top and bottom stroke so that the wings do not collide on crossing,

The curved path *CFD* of Fig. 4 is a consequence of uniform velocity and varying feathering in rotary wings. Therefore, any one wing trailing edge will describe in space one half (that shown in broken line) of a figure of 8 while making a downward and forward stroke during one half revolution, and the corresponding half 8 during the upward and backward stroke of the succeeding half revolution. With two wings a complete 8 must therefore be formed simultaneously on each side of the body, and with 1,000 r.p.m. the effect will be similar to that given by a flapping insect wing. The advantages over the natural wing type are the absence of reversal stresses and the utilising of the full revolution for useful work.

The usual means of control can be used with this construction, and a variable feathering can be obtained if the cam races on the cam plates are formed of laminated spring leaves having levers in rear so as to cause a hump or cam contour where desired.

Even with wings of 10 ft. length the ground clearance or landing chassis height corresponds to ordinary practice, since approximately 7 ft. vertical height would allow free play for the inclined stroke of the wings.

To convert the idea contained herein to a truly practical conclusion would require the solving of many difficult problems of control, but the evolution of the conventional aeroplane was by no royal road. I would be very glad to know of any experimental work carried out and bearing on the above.

"AEROSTAT."

THE ROLL OF HONOUR.

REPORTED by the Admiralty:—

Killed.

Flight Sub-Lieut. the Hon. Arthur C. Corbett, R.N.

Accidentally Killed.

Flight Sub-Lieut. Alfred T. O. Mann, R.N.

Died of Injuries.

Flight Sub-Lieut. Neville W. Frames, R.N.

Missing (believed Killed).

Lieut. Percy M. Woodland, R.N.V.R.
Flight Sub-Lieut. Alfred J. Nightingale, R.N.

Missing.

Flight Lieut. Edward J. Cooper, R.N.
Lieut. Lord Torrington, R.N.V.R.
Flight Sub-Lieut. Charles W. Greig, R.N.
Flight Sub-Lieut. Guy L. Davies, R.N.
Flight Sub-Lieut. Charles T. Brimer, R.N.
Sub-Lieut. Rowland W. Frazier, R.N.V.R.
Sub-Lieut. Alick C. Stevens, R.N.V.R.

Slightly Wounded.

Flight Sub-Lieut. Geo. S. Abbott, R.N.

Reported by the War Office:—

Died of Wounds.

7600 2nd Air-Mech. E. C. Josling, R.F.C.

Wounded.

Lieut. W. A. Dunn, R.F.C.
2nd Lieut. J. C. Griffiths, R.F.C.
2nd Lieut. P. J. Long, A.S.C., attd. R.F.C.
2nd Lieut. C. F. Wolley-Dod, Sher. Foresters, attd. R.F.C.
6640 1st Air-Mech. H. Alexander, R.F.C.
8656 2nd Air-Mech. W. C. Mann, R.F.C.
15788 1st Air-Mech. T. H. E. Sawyer, R.F.C.

Missing.

2nd Lieut. G. S. Deane, R.F.C.
24130 Sergt. C. G. Baldwin, R.F.C.

Previously reported Missing, now reported Killed.

Lieut. A. H. T. L. Speer, R.F.A. and R.F.C.
2nd Lieut. W. A. Wedgwood, R.E. and R.F.C.

Previously reported Missing, now reported Prisoner of War.

13958 Corpl. W. Summers, R.F.C.

Previously reported Wounded, now reported not Wounded.

2nd Lieut. J. E. Burt, Middlesex, attd. R.F.C.

Now reported Wounded and Prisoners of War in German hands.

Lieut. L. R. Briggs, London Regt. and R.F.C.
Lieut. J. H. Lowsen, R. Scots and R.F.C.

Previously reported Missing, now reported Died as Prisoner of War in German hands.

Lieut. E. C. Lansdale, A.S.C. and R.F.C.

Previously reported Missing, now reported Prisoners of War in German hands.

Lieut. G. Wadden, R. Irish Fus. and R.F.C.
2nd Lieut. C. L. Roberts, S. Lancs. and R.F.C.

Correction: **Wounded.**

Capt. H. G. Richards, R.F.A., attd. R.F.C., should read 2nd Lieut. H. W. B. Richards, R.F.A., attd. R.F.C.

Fatal Accidents.

AT an inquest on Lieut. H. S. Brewster, Royal Canadians, attd. R.F.C., who was killed on December 6th, while flying, the evidence showed that when at a height of about 200 ft. his machine nose-dived and crashed to earth, Lieut. Brewster being killed instantly. It was thought he attempted to descend too steeply.

A verdict of "Accidental death" was returned.

"Death through misadventure, owing to an error of judgment when about to land," was the verdict at an inquest on Lieut. C. T. Miller, Canadian Regt., attd. R.F.C., who was killed on Friday. According to the evidence the machine was thoroughly explained to the deceased before he ascended. He got to 1,000 ft., did three circuits, and then apparently began to descend. When abont 100 yards from the aerodrome he appeared to "stall" the machine, which nosed straight to the ground.

Lieut. G. A. Powell, of the R.F.C., was knocked down by a motor-cyclist on the night of December 8th, near Thetford and received fatal injuries.

A double flying fatality occurred on December 10th. Lieutenants Brooke and Lotinga, R.F.C., soon after ascent, appear to have lost control of the machine, for it was seen to nose-dive to the earth. The aeroplane was smashed, and both aviators were killed.

FLIGHT

DYNAMICAL STABILITY OF AEROPLANES.

By JEROME C. HUNSAKER.

(*Concluded from p.* 1081.)

Spiral Dive.

The first factor may correspond either to a damped or to an amplified motion, depending on whether the aeroplane be stable or unstable. At high speeds model S shows a subsidence damped to half amplitude in 10·4 secs. At lower speeds this damping diminishes, and at 37 miles per hour the motion becomes a divergence which doubles in amplitude in 7·2 seconds. Examination of the preponderating terms in the expression representing the motion shows that the aeroplane starts off on a spiral dive. There is a tendency on side-slip or "skid" to the right, for example, for the aeroplane to head to the right toward the relative wind due to vertical fin surfaces on the tail acting as a weathervane. At the same time, due to spin in yaw, the machine banks to the right suitably for a right turn due to greater lift on the left or more rapidly moving wing. The increased bank increases the side-slip, the yaw becomes more rapid and in turn the overbanking is magnified. The aeroplane starts off on a spiral dive, and will spin with constantly increasing angular velocity unless the pilot intervene with his controls.

The spiral dive is corrected if the aeroplane have a preponderance of fin surface above the centre of gravity or if the wing tips be raised. There must be such an arrangement of surfaces that when the aeroplane side-slips to the right it banks suitably for a left turn. Then it will be restored to its normal attitude. A simple relation may be obtained involving four of the aerodynamical coefficients which, if positive, insures that spiral instability of this kind is not present.

It appears that spiral instability is caused by too much fin surface to the rear or too large a rudder, and by not enough fin surface above the centre of gravity. A proper adjustment is easily obtained without sacrifice of desirable flying properties.

The aeroplane S is stable spirally at all reasonable speeds. It has a small rudder and wing tips raised about 1·6°. At extreme low speed (when stalled), there is spiral instability caused by the righting moment due to side-slip becoming small. The effect of the slight dihedral angle of the wings is not of much assistance at large angles of incidence, and it may be preferable to fit true vertical fin surface, whose stabilising effect should be independent of attitude.

Aeroplane U is spirally unstable at high speeds. It has no rise of wing tips nor vertical surface above the centre of gravity, and has a very deep body giving the effect of a rear vertical fin.

Rolling.

The second factor in the equation of motion represents a rolling of the aeroplane which is so heavily damped by the wide-spreading wings as to be ordinarily of no consequence. In the extreme case of a "stalled" aeroplane, the damping of the roll vanishes because the downward moving wing has no more lift than the other. Here we may expect trouble, and frequent accidents to stalled aeroplanes indicate that the pilot's lateral control by *ailerons* also becomes inoperative. For reasonable flying speeds, this factor should not lead to any instability.

Dutch Roll.

The third element in the motion is a yawing to right and left of the course combined with rolling. The motion is oscillatory of period from 5 to 12 seconds, which may or may not be damped. We may imagine an aeroplane which is spirally stable to yaw to the right accidentally. Due to fin surface above the centre of gravity it banks in a manner proper for a right turn, but the roll is resisted by the damping of the wings. The turn is assisted by the increased resistance of the downward moving wing, but eventually the weathercock effect of fin surface at the tail turns it back into the original course. As the machine swings back to her course, the bank flattens out. But, due to angular momentum, she swings out to the left, and banks for a left turn. This swinging to right and left is accompanied by rolling and some side-slipping.

The analogy to the "Dutch Roll" or "Outer Edge" in ice-skating is obvious. If the skater lean too far out on his swings he may fall, and in the same manner if the aeroplane bank too much a slight puff of wind may capsize it.

The motion in the Dutch "Roll" is stable provided there be sufficient vertical fin surface on the tail, and not too much fin surface above the centre of gravity. These requirements conflict with those previously stated for spiral stability, and a compromise must be made. Over-correction of spiral instability may produce instability in the "Dutch Roll" and *vice versa*. Fortunately, the damping of rolling by the wings is helpful in both cases, and it appears possible to obtain that nice adjustment of surfaces which will render both motions stable.

Model S was stable in the "Dutch Roll" at all speeds, having a period from 6 to 12 seconds, and the initial amplitude damped 50 per cent. in from 1·5 to 6 seconds. Model U was stable in this respect at low speed, when it showed a period of 6 seconds and the initial amplitude was doubled in 8 seconds. Here the aeroplane was practically "stalled," and the damping of the roll due to the wings was only one quarter of its value at high speed.

General Conclusions.

It is believed that the majority of modern aeroplanes are spirally unstable, but stable in the Dutch Roll. Furthermore, it appears to be a simple matter so to adjust surfaces that any aeroplane can be made completely stable without sacrifice in speed or climb. At extreme low speed an aeroplane must be unstable in its longitudinal motion, but need not be unstable laterally.

The degree of stability to provide in a given case cannot be determined from mechanical considerations, but certain general conclusions may be indicated. For example, the comfort of the pilot must be the first consideration, and for this reason the righting moments giving statical stability should be small; the period of the aeroplane can then be made relatively slow, and if the damping is adequate the free oscillations will be stable.

The theory is applied here only to flight in still air. Obviously the air is never still, and the aeroplane must finally be judged from its behaviour in gusts. An inherently stable aeroplane tends to preserve its normal attitude with relation to the relative wind, and if the velocity and direction of the relative wind change in an irregular manner, the stable aeroplane will tend to follow in an effort to preserve the same relative air speed and longitudinal attitude. The result will be to force a motion of the aeroplane, which will be more violent the greater the statical stability. Consequently in rough air an aeroplane very stable statically is unsuitable as a gun platform, and for many other military purposes. A machine whose inherent statical stability is slight or nearly neutral should be slow to respond to gusts.

The stable aeroplane, if the pilot abandon his controls, tends to fly in such a manner that the relative air speed and attitude remain constant. In good weather, the pilot may, therefore, abandon his controls at intervals to make observations which ordinarily would require an assistant as observer. However, this very tendency of the machine to adjust its flight path may prove a source of danger when the piolet wishes to make a landing in a small field. Here the machine, if struck by wind gusts, will attempt to "take charge" in resistance to the pilot's efforts to direct it. A very stable aeroplane is not, therefore, so completely under the pilot's control as one whose stability is slight.

For the determination of the degree of stability suitable for

Aeroplane... ...	S.	S.	S.	U.	U.
Wing area ... ... sq. ft.	464·	—	—	384·	—
Span ... ... ft.	40·2	—	—	36·	—
Chord ... ... ft.	5·77	—	—	5·3	—
Weight ... ... lbs.	1600·	—	—	1800·	—
lbs. per sq. ft.	3·55	—	—	5·2	—
Rise of wings	1·63°	—	—	0°	—
Angle of incidence	0°	6°	12°	1°	15·5°
Velocity ... ... miles	76·9	44·6	36·9	78·9	43·6
"Spiral" motion—					
Damp 50 per cent. secs.	10·4	2·7	—	—	3·3
Double ... ... secs.	—	—	7·2	28·0	—
"Dutch" roll—					
Period ... ... secs.	5·9	10·7	12·0	5·2	5·7
Damp 50 per cent. secs.	1·4	1·3	6·0	1·8	—
Double ... ... secs.	—	—	—	—	7·7

military aeroplanes we must finally depend upon the preferences of pilots. A knowledge of the natural periods and damping coefficients should then furnish a means for fixing the verdict of experience, so that in future the desired degree of stability may be provided.

Considerations of theory indicate that a slight degree of statical stability combined with the maximum of damping give an aeroplane slow periods of oscillation and a dynamically stable motion, with little ill effect upon performance or controllability.

The table summarises the results obtained for the lateral motion.

AIRCRAFT WORK AT THE FRONT.

OFFICIAL INFORMATION.

British. *General Headquarters, December 5th, 10.52 p.m.*

"Yesterday our aircraft carried out much successful artillery and reconnaissance work, and bombed, among other objectives, a railway station and an aerodrome.

"The Naval Air Squadron had many combats, and were most successful, driving down two hostile machines out of control and forcing seven others to land. In all two hostile machines were destroyed and four driven down out of control, in addition to those forced to land. One of our machines is missing."

War Office, December 8th.

"*Tigris Front.*—On Dec. 4th hostile aeroplanes bombed our camps. In retaliation a flight of six British machines dropped half a ton of explosives on Turkish camps, and caused considerable damage."

French. *Paris, December 5th.*

"Yesterday Second-Lieut. Nungesser successively brought down on the Somme front two German machines, the first at 12.15 p.m. and the second at 1.5 p.m. One of the machines came crashing to the ground 300 metres west of Nurla. The other fell in flames in the Vallulart Wood, east of Lechelle. These two successes bring the number of enemy machines forced down by Second-Lieut. Nungesser to twenty."

Paris, December 6th.

"It is confirmed that Adjutant Dorme brought down on the 4th inst. his seventeenth enemy aeroplane. The machine fell from a height of 600 metres, near Mons-en-Chaussée (south-east of Péronne). The same day Qr.-Mr.-Sergt. Viallet brought down his seventh enemy aeroplane, which fell from a height of 700 metres, east of Beugny (in the region of Arras.)."

Paris, December 10th.

"On the night of Dec. 9th, one of our aeroplane detachments dropped many bombs on the railway stations and military establishment of Martigny, Ham, and Mons in Chaussée."

Paris, December 11th.

"During the day (yesterday) two German aeroplanes were brought down by our pilots on the Verdun front. One of them fell in flames near Brabant-sur-Meuse, the other crashed to the ground near Herneville. Our aviators fought several battles on the Champagne front yesterday, in the course of which Pilot Sergt. Sauvage brought down his seventh German machine, which fell in flames south of Monthois. The second enemy machine was brought down on the northern edge of the Bois d'Autry.

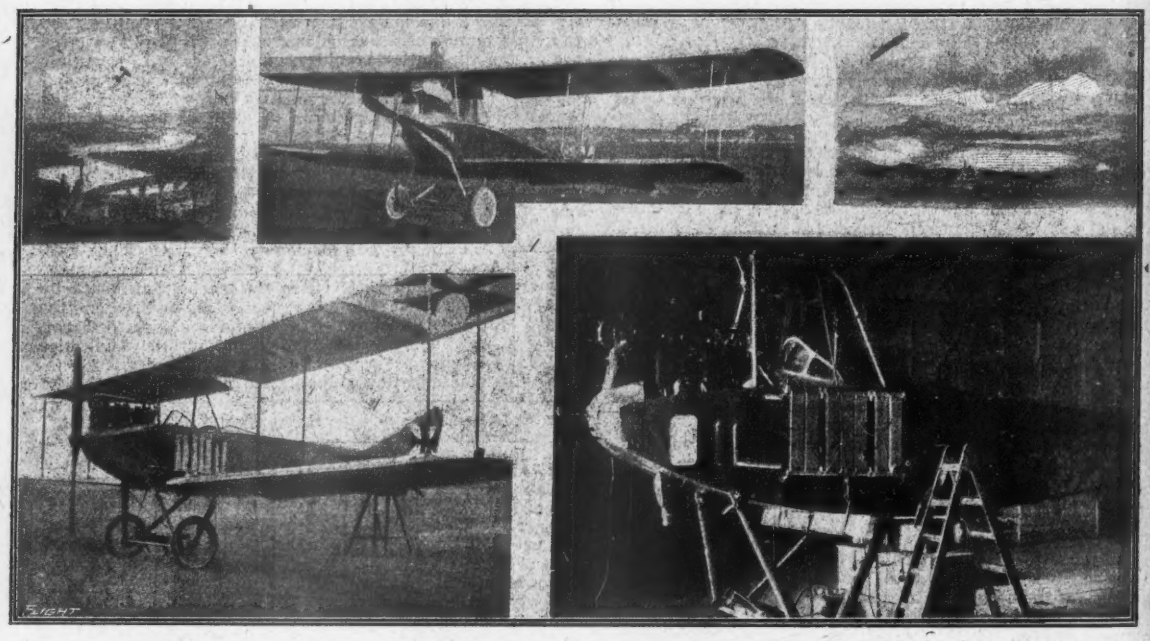
"Last night our bombarding aeroplanes dropped a number of projectiles on the enemy's munition dumps in the region north of Verdun. Several fires and powerful explosions were observed. Enemy cantonments at Romagne-sous-les-Cotes were also bombarded."

Russian. *Petrograd, December 9th.*

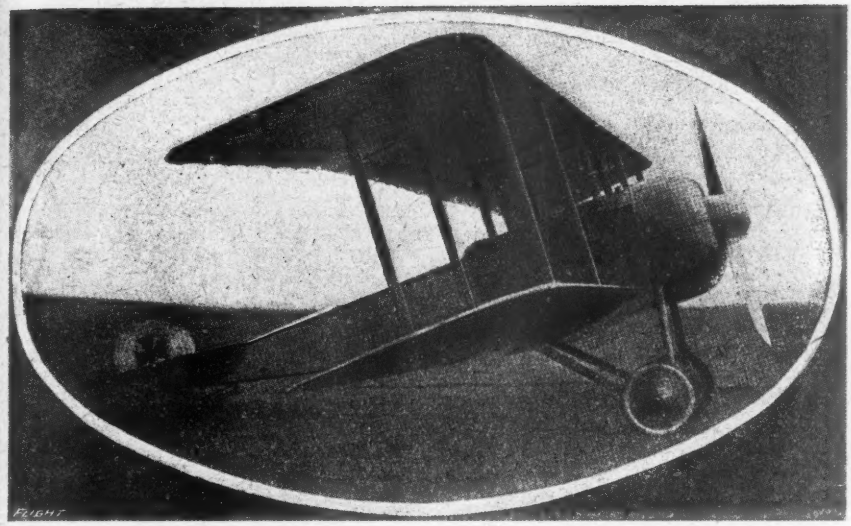
"*Western Front.*—Near the little place Pelikana, south of Lake Drisviata, a German aeroplane was brought down by our machine-gun fire. On descending the aeroplane overturned, and received considerable damage. The pilot and observer were taken prisoners."

Petrograd, December 10th.

"*Western Front.*—In an aerial combat in the region north of Dvinsk one of our aeroplanes came down in the vicinity of the Kolub Lake (16 miles north of Dvinsk). The machine was smashed, but the aviators escaped injury. Another



THREE GERMAN ALBATROS BIPLANES.—In the top photograph is shown a reconnaissance two-seater, having the radiator mounted above the engine, while below, the machine on the left is of the older type, with the radiators on each side of the body. The right hand photo. is of special interest as it shows the body of an Albatros which returned from a fight with Garros with twenty bullet holes through various parts of the *fuselage*.



A German Ago Biplane.—This machine, which is now, we believe, no longer used, is very similar to some of our own tractors, with its rotary (Oberursel) engine all covered in.

aerial engagement took place in the region of Illukst, as the result of which a German Fokker was hit and fell to earth almost perpendicularly. Our aeroplane, after accomplishing its prearranged reconnaissance, returned safely, notwithstanding the fact that the machine was pierced with numerous bullet holes."

Italian. *Rome, December 5th.*

"Hostile aircraft dropped a few bombs on Adria and Monfalcone without doing any damage."

Rome, December 7th.

"Enemy aeroplanes dropped bombs in the Aquileia district, killing a woman, and wounding a child. Our aeroplanes bombed the enemy aviation sheds at Prosecco and the floating hangars on the Trieste pier with marked success, as a reprisal. They returned safely to our lines."

German. *Berlin, December 8th.*

"In spite of the generally unfavourable weather great successes were obtained during November by our air service. Our own losses of thirty-one aeroplanes in the west and east, in Roumania, and in the Balkans are balanced by the following enemy numbers :—

Lost in aerial battles	71
Shot down from the earth	16
Involuntary landings	7
Total	94

"Of these, 42 are in our possession, and 52 were observed to fall down on the other side of the lines. The aviators, both of the artillery and infantry, gained for themselves, by the very excellent execution of their important tasks, the recognition and confidence of the other troops. Headquarters highly appreciates their achievements."

Berlin, December 11th.

"On the Verdun front during aerial fighting seven enemy planes were brought down by anti-aircraft guns and by our machines."

Austrian. *Vienna, December 4th.*

"Italian air squadrons unsuccessfully bombed Dutoolje, Grossrepen, and Sesana. Our airmen attacked the enemy, and forced a Caproni machine, with its four occupants, to land near Mayhinje. In this air fight Naval Lieut. Banfield and Lieut. Bronowski distinguished themselves.

"On Sunday evening one of our naval squadrons successfully bombed an enemy position near Doberdo, and returned safely, in spite of being heavily bombarded."

Vienna, December 6th.

"On Dec. 3rd a Royal and Imperial aeroplane squadron dropped bombs on the barracks of Ciungi. Several hits were obtained without any damage being done to the squadron."

Bulgarian. *Sofia, December 7th.*

"In this region (northern shore of Lake Tahinos) our guns brought down an enemy aeroplane, which was burnt."

Turkish. *Constantinople, December 5th.*

"A British biplane was brought down by our fire on the Syrian coast, near Remble. The pilot and observer were taken prisoners."

Constantinople, December 11th.

"*Tigris front.*—Our aeroplanes successfully dropped bombs on an enemy airshed, and forced two aeroplanes to descend."

DOWN!—A remarkable photograph of an observer leaving his kite balloon in a parachute. (*By courtesy of our Dutch contemporary "Avia."*)

SIDE-WINDS.

ANOTHER Cellon extension—this time in the telephone department. A new number—London Wall, 3622—has been installed in addition to the familiar London Wall, 5359. Clients are, however, asked to continue to use the old number as far as possible, so as to leave the other free for outgoing calls.

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BY the way, the unique collection of pictures, photographs and curios which Mr. A. J. Wallace Barr has in his offices at Broad Street House, New Broad Street, is steadily growing—in fact, there is a pretty big nucleus of what promises to grow into a veritable aero museum.

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THE National Aircraft Manufacturing Co., of Printing House Yard, 15A, Hackney Road, N.E., has not been long in finding extensions necessary, and has now taken over two more large workshops for woodwork. The firm are in the happy position of being able to obtain all the labour necessary and under the able guidance of one of the oldest hands in aviation, is forging ahead. A new department has now been installed and equipped for turning out all metal fittings for aircraft.

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SIMMS MOTOR UNITS, LTD., are now installed in their new headquarters, Percy Buildings, Gresse Street, Rathbone Place, W. Their telephone call is now Museum 2460 and 2461.

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THOSE who are on the lookout for timber, should specially note that Messrs. Chas. Boss & Co. (Liverpool) have now on the way to Liverpool about 100 stds. Prime Silver Spruce, all rift sawn.

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REALISING that the bulk of Barimar scientific welding work is either directly or indirectly for the naval or military services or for public undertakings, all the company's expert workmen, we learn, have decided to restrict the Christmas holiday arrangements, and confine them to Monday and Tuesday (Christmas Day and Boxing Day). Having regard to the extreme pressure under which Barimar, Ltd., have been operating at 10, Poland Street, ever since the inception of the war, and to the men's ready compliance with official requests to cut out summer holidays, it would not have been unreasonable if they had asked for the extension of two days provided for in certain cases by the Ministry of Munitions. There is, however, no sign of relaxation or diminution of the demands for urgency in the treatment of fractured machinery used for National purposes, and Barimar workers do not intend to allow the country's interests to suffer for purely personal reasons.

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THOSE who are considering the use of obturators or flexible piston rings, either in rotary engines or engines with fixed cylinders will be interested to hear that Engineering and Arc Lamps, Ltd., of Sphere Works, St. Albans, are introducing a new form of obturator. It is stated that a set of these obturators taken from stock, when tested in an air-cooled engine of 110 h.p., showed a life of 63 hours, without any loss of power and very little wear. The engine was first run for 47 hours, and then, after cleaning, for a further 16 hours.

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ON the passing of Mr. Pemberton Billing's interests in the company of Pemberton Billing, Ltd., which he founded, to the remaining directors by purchase, the name of the company has now been changed to "The Supermarine Aviation Works, Ltd." An excellent title, and one which secures to them the very happily coined word "Supermarine," also a brain-wave of "P.B." The company will continue as heretofore under the personal management of Mr. H. Scott-Paine. The address and works remain as before at Southampton.

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THE problem of finding Christmas presents for Service pilots and other aviators is not a difficult one if a visit is made to Messrs. Robinson and Cleaver's showroom at 156-158, Regent Street. The success of their special aviation department is sufficient proof that both price and quality are right, and the firm have on view a fine range of articles and equipment which form suitable and practical gifts at this season.

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ATTENTION may also be drawn to the fact that the Annual Christmas Bazaar at Gamage's in Holborn is open, and offers a unique opportunity for obtaining Christmas gifts for young and old. In their aviation department there is no lack of good things, any of which would be welcomed and appreciated by officers and men in either of the flying services, while for the young idea, with a hankering for aviation, there are toys in plenty—model aeroplanes, kites, engines, &c.—and at prices to suit all pockets.

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A REMINDER may also be given that the G.A.C. series of wristlet altimeters, compasses, &c., form Christmas presents which never fail to be appreciated by the recipient, and they can be obtained at 30, Regent Street, Piccadilly Circus, S.W., in a variety of styles to suit all requirements.

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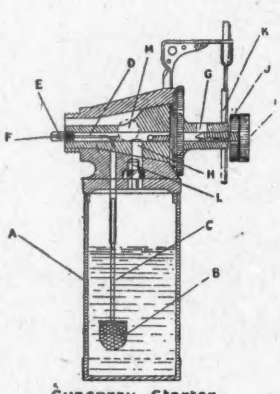
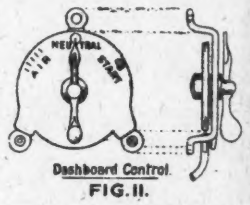
TO FACILITATE STARTING UP.

ONE of the chief troubles in connection with the internal combustion engine is the difficulty often experienced in starting up, especially when a petrol substitute or mixture is being used. Many inventive minds have tackled the problem, and quite a number of devices have been placed on the market from time to time. One little fitting for the purpose, which is now being introduced by Messrs. Gunspray, Ltd., 39, St. James's Street, S.W., is the "Gunspray" shown in the accompanying drawings. From the small service tank shown in Fig. 3 the petrol runs down into the reservoir *A* of the starter, which is seen in section in Fig. 1. On the engine being turned half a revolution, the suction at *F* draws the petrol up through the gauze strainer *B* and pipes *C* and *D* to the mixing chamber *E*, where it meets the air admitted at *G*. The amount of air which is allowed to enter is regulated by the screw valve I, and when the correct adjustment is reached, it may be locked by the milled nut J. The device is controlled by the pointer shown in Fig. 2, which is fixed on the dashboard and connected by a Bowden cable to the wheel *K*. With the pointer placed on "Start," the "Gunspray" delivers a correct explosive mixture, and as soon as the engine is warmed up, the usual fuel supply should be turned on, and the pointer turned to neutral, thus cutting off the starting mixture.



Gunspray Starter and Fuel Economiser

FIG. I.



Dashboard Control.

FIG. II.

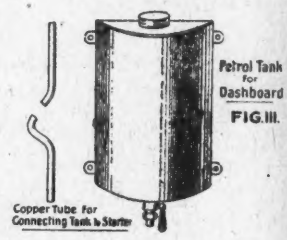


FIG. III.

Apart from its use for starting purposes, the "Gunspray" is also claimed to be a fuel economiser, as by gradually moving the pointer to "Air," a port is opened which admits extra air to suit the requirements of the engine.

Another advantage claimed for the "Gunspray" for use on cars is that, in the event of carburettor trouble, it would be quite possible to get home with the aid of the "Gunspray," a consideration which those who have ever been stranded by elusive carburettor trouble will appreciate.

The fitting of the "Gunspray" is quite a simple matter, and can be effected generally in about 20 minutes, while its addition to the equipment means very little extra weight, as it is said to weigh less than 20 ozs. The cost, complete, is £5 5s.

Models

"Pusher" and other Models.

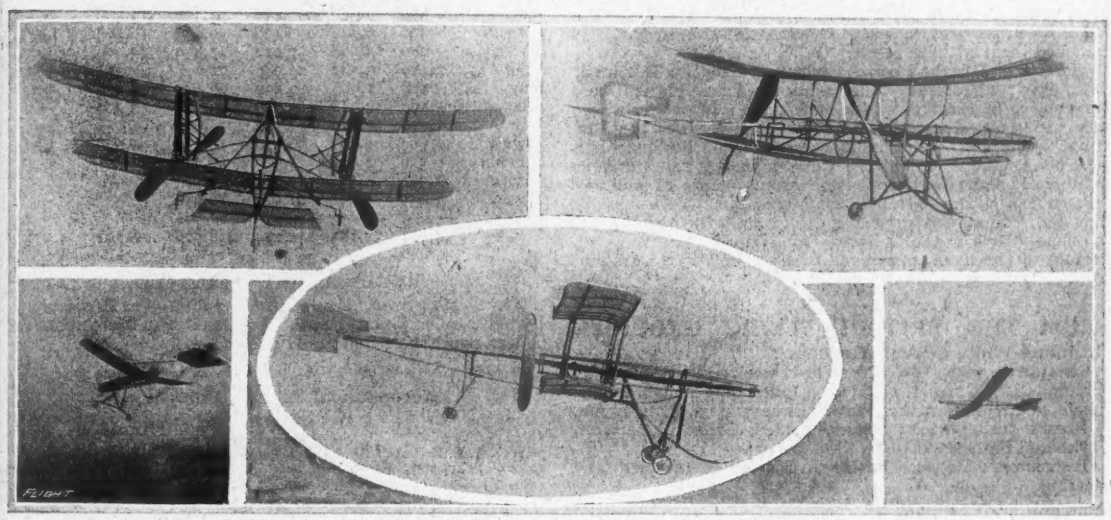
MR. J. W. REID having joined the Royal Fusiliers, the whole of the senior members of the South-Western Aero Club are now with the Forces, and so the club is suspended for the duration of the war. In sending along some time ago this item of news, Mr. Reid also enclosed a few photos of some of his latest machines, and no doubt many of our readers will be interested in the "pusher" machines, especially the biplane with its twin propellers. Writing with regard to these, Mr. Reid says :—

"Of the two photos. in flight one shows my tractor monoplane which is about 44 ins. span, 40 ins. long, with a 12-in. propeller. Mr. Howse made one slightly larger, which would go for about 43 secs. against my 37-38 secs.

"In October, 1915, I started experiments with single pusher machines after the style of the Mersey monoplane of a few years ago. Of the third machine I enclose one photo. in flight. It made its first appearance in early December, and showed very great steadiness, but was rather under-powered. After tuning up it flew well and consistently with remarkable steadiness in quite high winds, which my tractor could not tackle. Its two predecessors both had a similar fault, that of nose diving and stalling unaccountably. I eventually traced that to side area, and experiments in that direction helped me considerably in designing the last model of that type, and later my twin pusher biplane. The principal measurements of my single pusher mono. were : Span, 43 ins. ; length overall, 40 ins. ; diameter of propeller, 12 ins. ; length of motor, 21 ins., giving a duration of 20–25 secs., the propeller being driven by 10 strands of ¼-in. strip rubber geared in the *middle*, which is situated at the front end of the body.

"On January 1st I commenced work on my twin pusher biplane.

"It was finished at the end of February, and during March was out for first trials. Before I enlisted I was only able to test it once more, when it showed up quite well considering that it was rather under-powered. The chief measurements are : Span, top plane, 49½ ins. ; bottom plane, 40 ins. ; chord, 7 ins. ; propellers, diam., 12 ins. (These were badly made, and only gave a combined thrust of 4 ozs.) The motors were similar to that on the pusher monoplane, and were 20 ins. long and detachable. Total weight of model, "all on," 18 ozs., and area about 430 sq. ins.

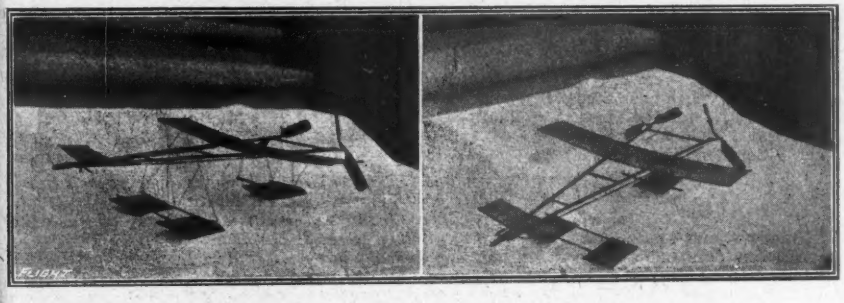


"Its tests were never completed, my enlistment interrupting them, but I am quite convinced that another month's work and that model would easily have been the steadiest and most consistent flyer I have made. I expected to get 20 to 25 secs. duration (25 secs. were actually obtained), which I know is very little, but quite sufficient to show up the worth of the model."

A Waterplane Model.

Mr. G. Allen, a New Southgate reader, sends the following details of an interesting waterplane model :—

"Enclosed please find two photos. of a model hydro-aeroplane I have recently constructed, and below give a brief description.



A couple of snap-shots of the waterplane model described above by Mr. G. Allen.

"Frame, 33 ins. in length, ¼ in. spruce; main plane, 28 ins. by 5 ins. chord, covered with varnished silk; elevator, 9¼ ins. by 3 ins. chord; front floats, 6½ ins. by 2½ ins. by 1 in. deep, situated three inches in front of centre of gravity, varnished silk stretched over white wood frame; back float, 8 ins. by 3 ins. by 1 in.; distance between front floats, 6 ins.; propellers 9½ ins. in diameter; power, 12 strands ⅛ in. flat rubber.

"The model when wound up to 500 turns leaves the water in 12 ft. and the average duration is 15-20 secs., but I think it will be improved considerably when larger front floats are fitted as the model seems under-floated. The floats are attached to the frame (usual A type) by means of 18 gauge steel wire. The propellers are bent wood (birch), and varnished with three coats of copal varnish. A slight accident to front floats necessitated a rest in the hospital, and it is now undergoing one or two alterations. Thanking you for the assistance I have received from your excellent paper."

Bombing Raids in Belgium.

THREE British machines did extensive damage by bombing railway junctions near Brussels, on December 6th, according to the *Maastricht Nouvelles*. German anti-aircraft batteries attacked them without result.

The *Daily Telegraph* correspondent, writing on December 11th, says: "Yesterday and to-day the Allies' airmen were very active in Belgium. This morning a raid on Zeebrugge was carried out, about a dozen aeroplanes, so far as could be noted, taking part. On Sunday scores of the Allies' machines were flying about behind the German lines. An enormous number of bombs was dropped on various points of military importance. The German communications were greatly harassed, and so persistent and daring were the airmen that in some districts the railway troop traffic was stopped. Certain of the flyers were over Brussels, and others are said to have reached as far as Louvain."

FROM THE BRITISH FLYING GROUNDS.

Grahame-White School, Hendon.

STRAIGHTS with Instructor, last week: Mr. Scudamore. Circuits with Instructor: Messrs. Coltman, Fielding, Nightingale, Pearman, Lord and Shaw. Circuits alone: Mr. Flynn.

Brevets during week: Messrs. Balden, Green, Robertson, Styles and Sutherland.

Instructors: Messrs. Pashley, Biard, Fitzsimons and Meering.

Bournemouth School.

STRAIGHTS alone, last week: Messrs. Ross, Fisher and Green. Half-Circuits alone: Messrs. Peat and Vermorel. Circuits and eights: Messrs. Allen and Little.

Instructors: Messrs. E. Brynildsen and H. Smith.

Certificates taken during the week by Messrs. Hall, Allen and Little.

COMPANY MATTERS.

Frederick Sage and Co., Ltd.

THE report of Frederick Sage and Co., Ltd., states that, it having been found impossible to complete the accounts owing to the liability for special taxation not having been agreed, the meeting called for 19th inst. will be of a purely formal character, and will be adjourned until a date at which the balance-sheet and profit and loss account can be presented. The directors have resolved to pay on the 19th inst. a dividend of 6 per cent. on the preference shares and of 6 per cent. on the ordinary shares on account of the profits for the year ended 30th September last.

Palmer Tyre, Ltd.

THE report of the Palmer Tyre, Ltd., for the year ended September 30th, shows a profit of £10,687, to which has to be added £563 brought forward. The directors, for the third consecutive year, are able to recommend a dividend, free of tax, at the rate of 12½ per cent. per annum, and that £2,000 be carried to reserve, leaving to carry forward (subject to payment of directors' fees) £1,751.

"Shell."

THE directors of the "Shell" Transport and Trading Co. announce that they will pay an interim dividend on the ordinary shares on account of the year 1916 of 2s. per share (10 per cent.), free of tax, on January 5th. This is the same as paid last year.

Joseph Owen and Sons, Ltd.

THE report of Joseph Owen and Sons, Ltd., states that the profits for the year to June 30th were £59,137, and £1,378 was brought forward. A dividend of 6½ per cent. is proposed on the ordinary shares, placing £1,188 to a special reserve, £2,000 to the reserve for debenture redemption and £6,500 to the reserve to provide for special war taxation, and carrying forward, subject to manager's commissions, &c., £2,489.

IMPORTS AND EXPORTS, 1915-1916.

AEROPLANES, airships, balloons, and parts thereof (not shown separately before 1910). For 1910 and 1911 figures, see "FLIGHT" for January 25th, 1912; for 1912 and 1913, see "FLIGHT" for January 17th, 1914; for 1914, see "FLIGHT" for January 15th, 1915; and for 1915, see "FLIGHT" for January 13th, 1916:—

	Imports.		Exports.		Re-Exportation.	
	1915.	1916.	1915.	1916.	1915.	1916.
	£	£	£	£	£	£
January ...	20,382	1,509	435	6,399	13,706	—
February	380	6,444	138	30,693	18,823	—
March ...	280	3,388	7,218	17,872	5,090	7
April ...	2,189	3,383	23,986	22,608	275	3,783
May ...	178	1,986	12,530	26,165	8,250	300
June ...	5,469	4,986	3,730	59,287	2,400	—
July ...	1,240	2,072	13,372	12,932	—	—
August ...	664	2,583	36,276	13,555	247	420
September	536	1,076	4,908	36,048	—	—
October ...	1,344	952	17,702	9,289	—	8
November	1,859	7,406	21,979	12,858	—	—
	34,521	35,785	142,274	238,706	48,791	4,518

PUBLICATION RECEIVED.

The Weather Map. An Introduction to Modern Meteorology. By Sir Napier Shaw, F.R.S. London: The Meteorological Office, South Kensington. Price 4*d*.

Aeronautical Patents Published.

Applied for in 1915.

Published December 14th, 1916.

16,189. J. R. K. LAW. Fire control devices for guns mounted on aircraft.
16,446. BLACKBURN AEROPLANE AND MOTOR CO. AND R. BLACKBURN. Machines for marking numbers, &c. on machine parts, &c.

Applied for in 1916.

The numbers in brackets are those under which the specifications are printed and abridged, &c.

Published December 14th, 1916.

584. C. H. BROCKELBANK. Apparatus for safe night-landing of aeroplanes. (102,164.)
1,179. SOC. ANON. SPAD POUR L'AVIATION ET SES DERIVES. Strutting and staying of aerial machines. (100,632.)

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12 „ „ ..	6	6	12 „ „ ..	11	0

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